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Some Toolroom Economies

By George C. Reilley

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Standardizing the shapes of cutting tools and making them easy to recognize — New supplies to be had only in exchange for old ones — Belts and slings

THE day has passed when the function of the tool room of a large manufacturing plant is merely to order tools, stock them and deliver them to the workman on the presentation of an order. Efficient tool stocking now involves also the vital features of standardization and economizing.

In the tool stock room at the Schenectady plant of the General Electric Company great strides have been taken with these objects in view. Perhaps the most striking impression gained by a visitor to the stockroom would be the unusually wide classification which the term "tools" is made to cover. Little by little the jurisdiction of the tool stockroom has been broadened to include such items as brooms, towels for wiping machines and work, belts and slings, etcetera.

Every article carried in stock is made to fulfill its function to the utmost. New tools are not furnished employes until an old one, sufficiently worn to have outlived its value, has been returned, or a definite requirement shown in the form of new machines or work which require new tool equipment. Worn tools are repaired and otherwise rehabilitated for the same or a new use.

As would naturally be supposed, the General Electric Company uses a large variety of high-speed steel cutting tools in its machining operations, varying in size from ¼-in. square tool bits to 1¼x2½x24-in. boring mill or planer tools. Up to a few years ago the Schenectady plant alone was using 198 different shapes of such cutting tools, despite some efforts to standardize.

A system was then adopted that brought about a material reduction in the number of cutting tool shapes

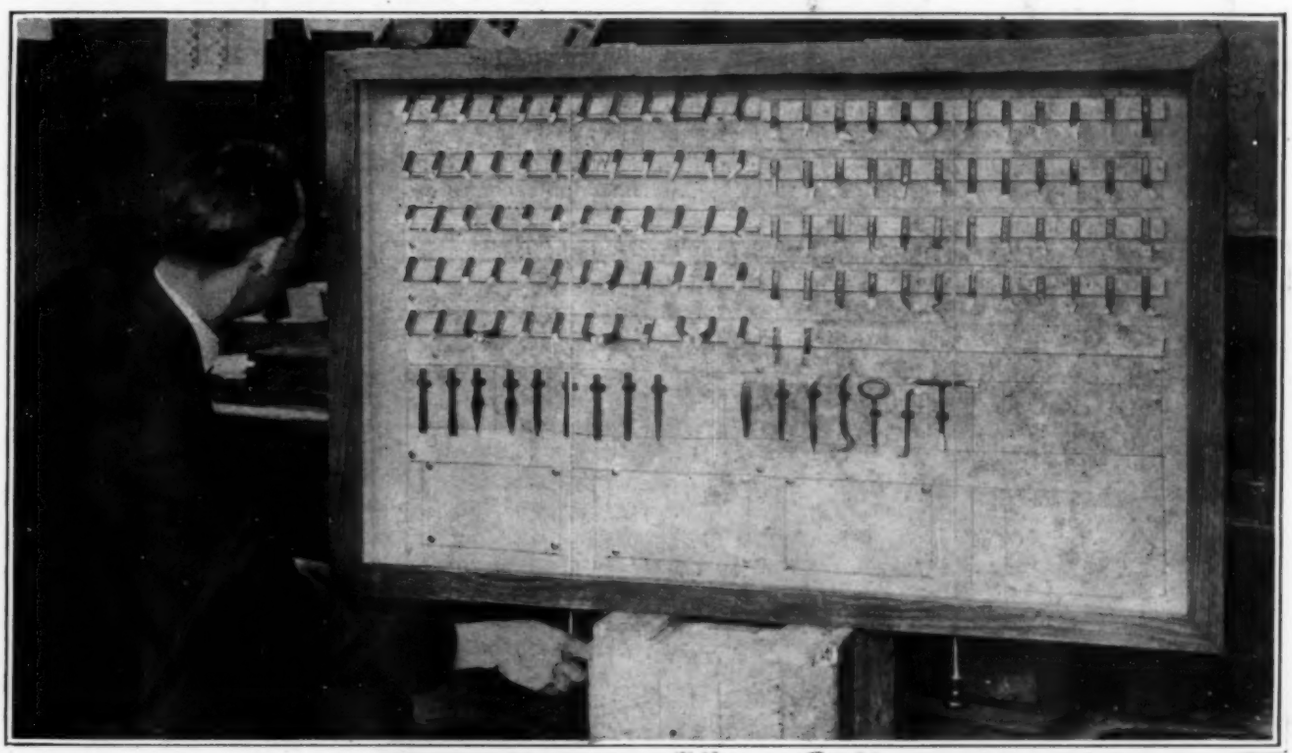


Fig. 1—Rack of tool replicas. Tool bodies are painted red and cutting portion white

used, and this system has but recently evolved into a still better method with increased possibilities for standardization. The first method was to photograph the various shapes of tools, illustrating a large number of shapes on one photograph, Fig. 2. By having these photographs on display at the different tool cribs, the workman who wanted a cutting tool for any purpose was enabled to select the shape needed, thus minimizing the possibility of having a new tool made when an old one was available to do the work. As a result of the adoption of this method, the number of standard cutting shapes was reduced from 198 to 112.

Due to the fact, however, that the workman was not always able to make the proper selection from a photograph, a new plan was devised. Small replicas of the tools themselves were made and these were arranged in

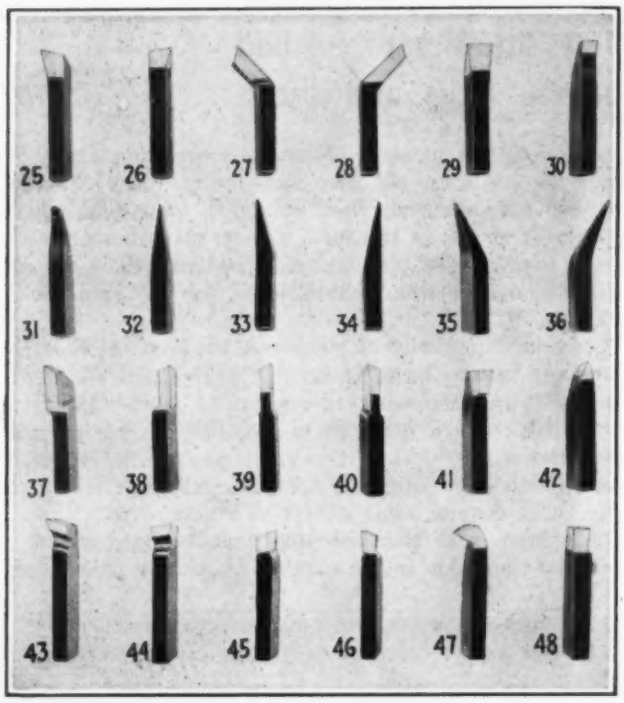


Fig. 2—Photographic representation of various shapes of cutting tools. This method was superseded by that shown in Fig. 1

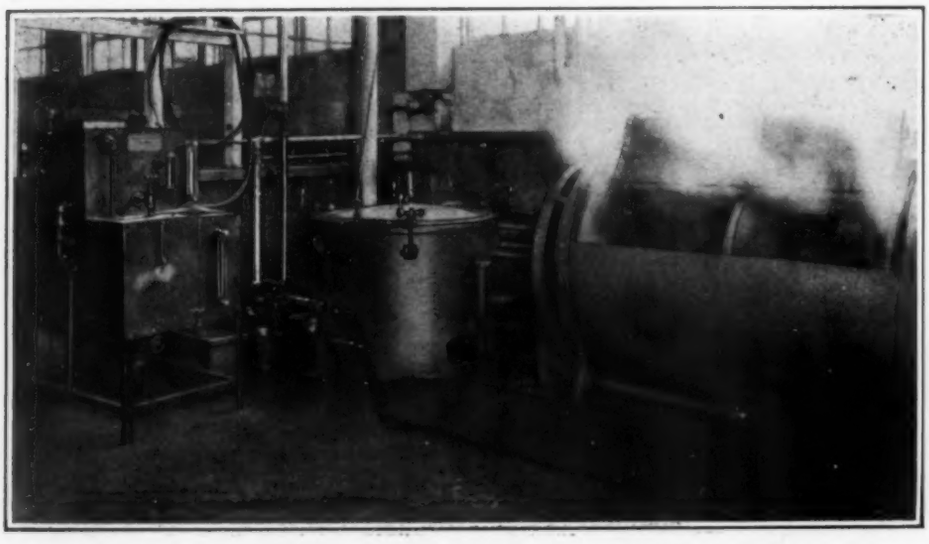


Fig. 3—Cleaner, oil extractor and oil filter used in reclaiming dirty towels

Fig. 4—View in towel reclaiming room. Above are the cleaned towels drying on racks. On the center of the table is a pile of dirty towels as they are received from the factory and at the left are the cleaned towels stacked in lots of 50

a rack with a glass cover, Fig. 1. Thus they are now visible in miniature to the workman. By painting the body of the tool red and the cutting portion white, the shape is plainly emphasized. In order to provide a means of viewing the tools from all angles, each row is secured to a rod and provided with a tilting arrangement. By pressing a master rod extending through the bottom of the case, a whole tier of tool models can be lifted from its position, allowing the workman to view the tools from several angles in much the same manner as he would were he handling the tool itself. It is expected that the use of this rack will still further reduce the number of standard cutting shapes.

When the cutting edge of any tool in use on a machine becomes too worn for further efficient service, the tool is returned to the tool stockroom to be exchanged for a new one. Old tools which have been turned in and which have become too short for use in their original sizes are either reforged or hammered down to the next smaller standard size. The tools are then replaced in stock in their new classifications and are ready to be used again.

When high-speed cutting tools have finally become too small for use in any machine, they are remelted and cast into ingots. The ingots are forged into billets, then drawn into bar stock, cut into tool lengths and reshaped into new tools.

Tools such as pliers or wrenches are, of course, re-

Fig. 5—One side of the belt rack. One workman is putting a large roll in place while the other is measuring off belting from another roll

claimed as much as possible. These are constructed of standard parts which may be renewed when too worn for further use. When, however, tools of either classification become so worn that they cannot be further reclaimed, they are scrapped. It is not sufficient to consign these to the scrap department and let it go at that.

Fig. 6—A sling tripod. Each tripod carries a supply of slings in 30 different lengths

All scrapping of this nature takes place under the personal supervision of a representative of the tool stockroom.

It is the general practice in large factories to use waste for wiping machines or work. About three years ago the plan was adopted at Schenectady of using towels instead of waste for this purpose. It was found that a towel was more sanitary, was cheaper in the long run and was often better adapted to the work than waste.

Two towels are charged to each man whose work requires their use. Dirty towels must be returned before clean ones are issued. The dirty towels are then sent to the tool stockroom for cleaning.

The cleaning process is an interesting one. Most of the dirty towels have a large oil content and the first step in cleaning is to extract it. This is done by placing the towels in an extractor which revolves at a high rate of speed, steam meanwhile being circulated through the towels. The oil is thus drawn off by centrifugal force, is filtered and then barreled for use in the plant, for applications where a low grade of oil is all that is required.

The towels are next placed in a washer and cleansed for one hour by a chemical and boiling process. They are then hung on racks for drying, each set of hooks holding two towels. Keymarks, spaced 25 hooks apart, simplify counting, the towels being removed from the hooks and piled in quantities of 50. About 3,000 towels are cleaned in this way each day.

Belting of all kinds has been stocked by the tool room for some time, and recently crane slings were also placed in stock. In line with the general practice, when a new belt or sling is called for the order is not filled unless it is accompanied by the old sling or belt to be replaced. New ones are not furnished unless it is shown that the old articles are no longer fit for service, or that there is a bona fide need for new ones as a result of the installation of new equipment. Those returned are inspected and, if any part is still good, they are reclaimed for smaller sizes and put back in stock.

The rack used for storing belting was designed to minimize manual labor in lifting the rolls into place and in dispensing belting as called for. Fig. 5 shows the construction of the belt rack. When a new roll of belting is to be placed in the rack, it is rolled up to the slip which it will occupy and upon a lever placed on the floor. A short length of piping is then passed through the center of the roll and the roll is lifted up the incline by means of the lever until the piping falls into place in parallel notches in the tracks. It is then a simple matter to unroll and cut off lengths as called for.

Until recently all slings were made in the rigging department and hung over a beam or rod. When a new sling was needed in the factory, a workman with an order visited the rigging department and chose the sling wanted from the assortment.

Slings are now stocked in the tool room where they are supplied on orders with the same discretion which characterizes all the activities of this department. Fig. 6 shows the sling rack or tripod used for this purpose. The slings are hung over rods, each rod holding slings of but one length. One of the striking advantages of this method of stocking is the great economy of space effected, one tripod carrying a sufficient stock of each of 30 different sling lengths.

In the endeavor to eliminate any unnecessary waste, the tool stockroom overlooks no opportunity, no matter

how insignificant it may seem. At first thought it might be felt that a broom offers a meager opportunity for economizing. But the stockroom at Schenectady found that brooms first used for sweeping floors can be further used for sweeping chips from large machines in the machine shops, after they have become too worn for their first service. After the brooms have become too worn for sweeping of any kind, the handles are cut off and sent to the wood-turning department, where they are utilized in making small handles for various purposes.

Test of Ball Bearings for Rotating Beam Fatigue Machine—Discussion

By Haakon Styri
S K F Research Laboratory

In an article with the same title, published by L. B. Tuckerman and C. S. Aitchison in *American Machinist*, Vol. 61, p. 369, some comparative tests on self-aligning and conventional single row bearings were described, from which the conclusion was drawn that the self-aligning bearing would introduce adventition moments and should therefore not be used for the rotating beam (Sondericker) testing machine. From our experience with the two types of bearings, this conclusion seemed entirely unreasonable, and we assumed the explanation for the difference observed was that the motor was mounted vertically when driving the self-aligning bearings, but horizontally when driving the single row bearings. In the first arrangement the driving torque from the motor would introduce a moment at right angles to the rotation of the arbor, and thus affect the self-aligning bearing.

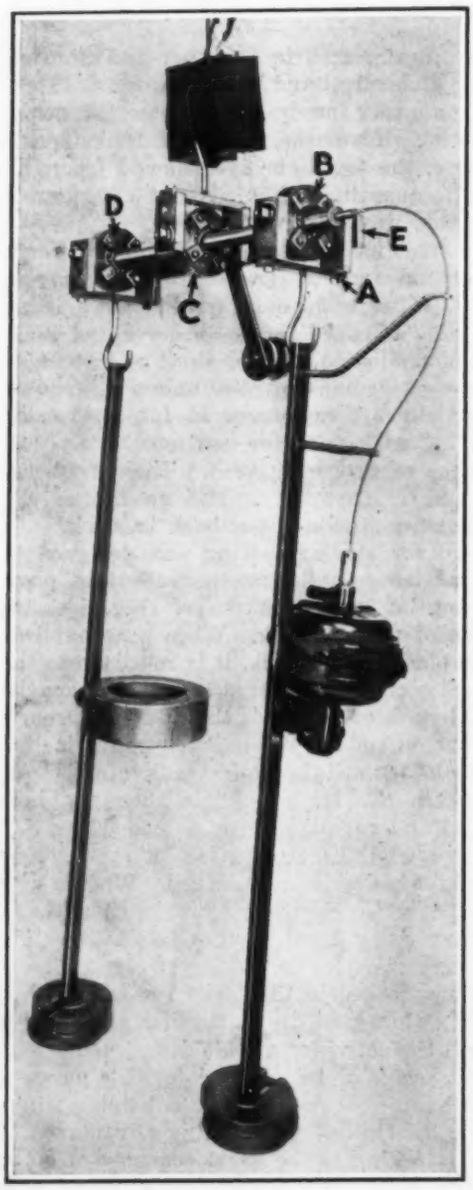


Fig. 1—Arrangement of test parts similar to that of Tuckerman and Aitchison

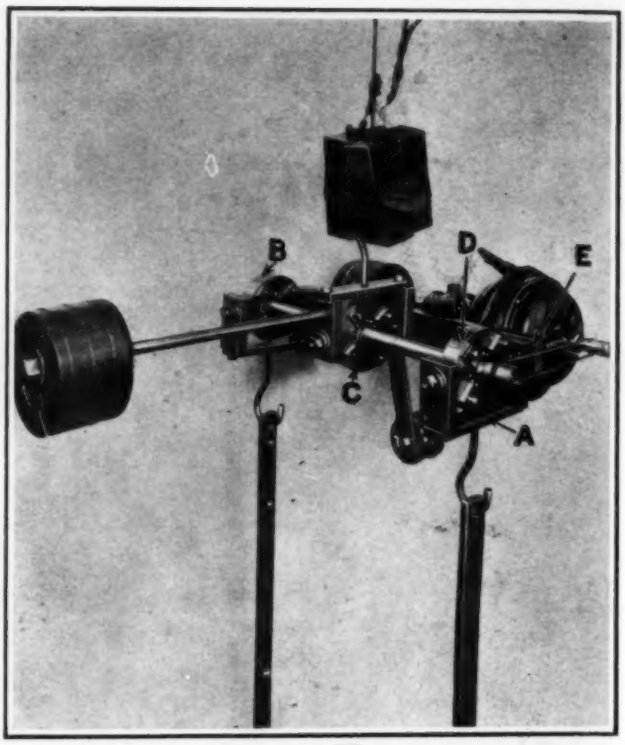


Fig. 2—Arrangement of test parts to eliminate vertical torque from motor

In Fig. 1 is shown an arrangement similar to the one used by Tuckerman and Aitchison for self-aligning bearings. A few additions have been made in order to eliminate some errors in the previous test. For balancing of the shaft when standing still, the yoke *A* is mounted with ball bearings on disk *B* which forms the housing for the self-aligning outer race. After balancing, the yoke is locked with a screw to *C*. During rotation of the arbor the self-aligning bearing will permit oscillation in the vertical plane without material resistance. Beam *E* is connected with the three yokes and disks *B, C, D* by single-row ball bearings coaxial with the disk trunnion, in order to prevent rotation of the yokes on a vertical axis.

The speed of the induction motor used for driving the arbor could be adjusted between 1,000 and 2,000 r.p.m. by changing the frequency of the current. The load on the pans was varied between 0 and 84 pounds.

The maximum unbalance produced could be checked by adding a 2-ounce weight in the pan opposite the motor-pan.

A second test was made to show the effect of eliminating the vertical torque from the motor. The arrangement is shown in Fig. 2, where the motor is mounted on beam *E* with the axis parallel to the arbor and with the weight of the motor counterbalanced. A rubber belt is used for driving the arbor.

With this arrangement no disturbance of equilibrium was noticed, and the balance was sensitive for an external load of 1 oz. or about 1 per cent of the maximum load used.

Tuckerman and Aitchison's conclusion is therefore apparently due to a misleading test arrangement. No adventition moment is caused by self-aligning bearings when properly mounted.

Automotive Production

Sheet-Steel Automobile Parts

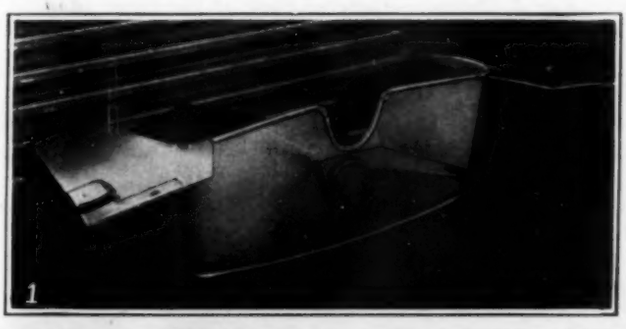
By John Younger
Associate Editor, *American Machinist*

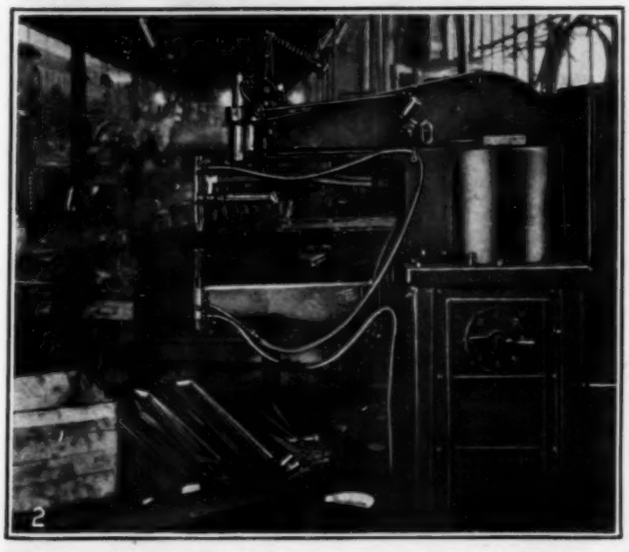
Use of sheet steel replacing castings and even forgings — Spot-welding process supplanting riveting—Built-up products becoming more popular—Light weight the ultimate goal

THE illustrations accompanying this article are taken from the works of the Hupp Motor Car Corporation in Detroit, and many of the examples are taken from the same source but the remarks apply to automobiles in general, and to the trend that exists toward the use of sheet steel in automobile construction.

One has only to examine the modern automobile body to realize the important part that sheet steel plays in the industry. Edward G. Budd, speaking before the Society of Automotive Engineers last January, demonstrated that the steel body was here to stay and that it is now a factor to be reckoned with. It is some 25 per cent lighter than the composite wood body and is correspondingly cheaper. It is built not along old fashioned body lines but according to modern engineering and production ideas.

Not only in the body but in the chassis as well, will be found numerous examples of where pressed steel is





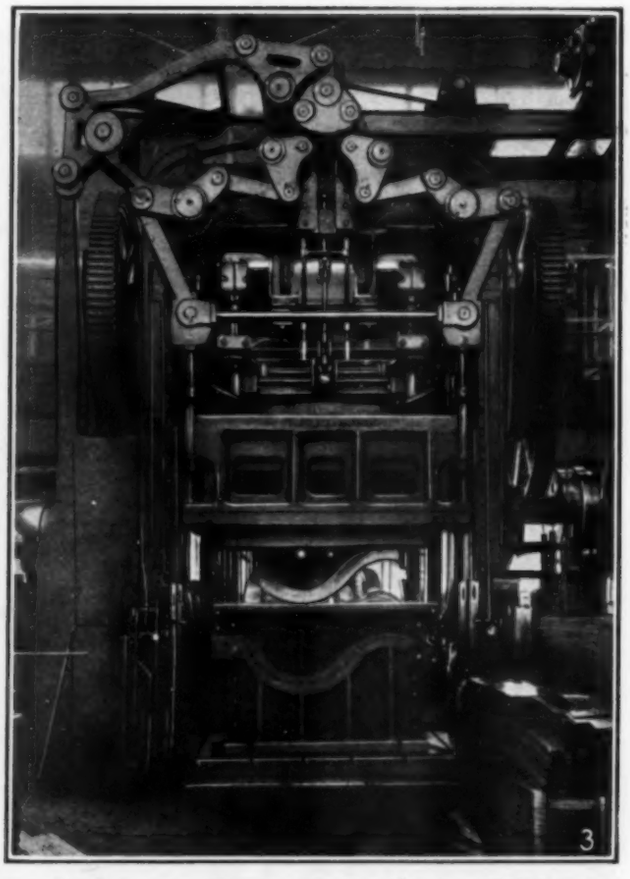


Fig. 1—A pressed-steel front apron. Fig. 2—Spot-welding crankcase parts. Fig. 3—Fender dies in a Toledo press

AUTOMOTIVE PRODUCTION

cutting into the ranks of the casting such as in Fig. 1, where the front apron of a Hupp automobile is seen. It will be noticed that this part is built up of several pieces spot-welded together. A typical machine for spot-welding is shown in Fig. 2 welding up a part that goes in the bottom half of the crankcase.

Spot-welding is most satisfactorily used in joining together pieces of similar thickness where the fastening can be in from the edge. Seam welding is best accomplished either electrically or by oxy-acetylene torch. One interesting development of spot welding is where strip steel is rolled to tubular form and then run between two copper wheels which act as the contact makers for the electric current and weld the butted faces of the tube together into a series of spots so close together that practically a continuous weld results. This tubing can be produced at speeds up to 100 ft. a minute and of gage up to 16. It is used for steering columns, exhaust pipes, heater tubes and manifolds. The muffler can be built up almost entirely of it.

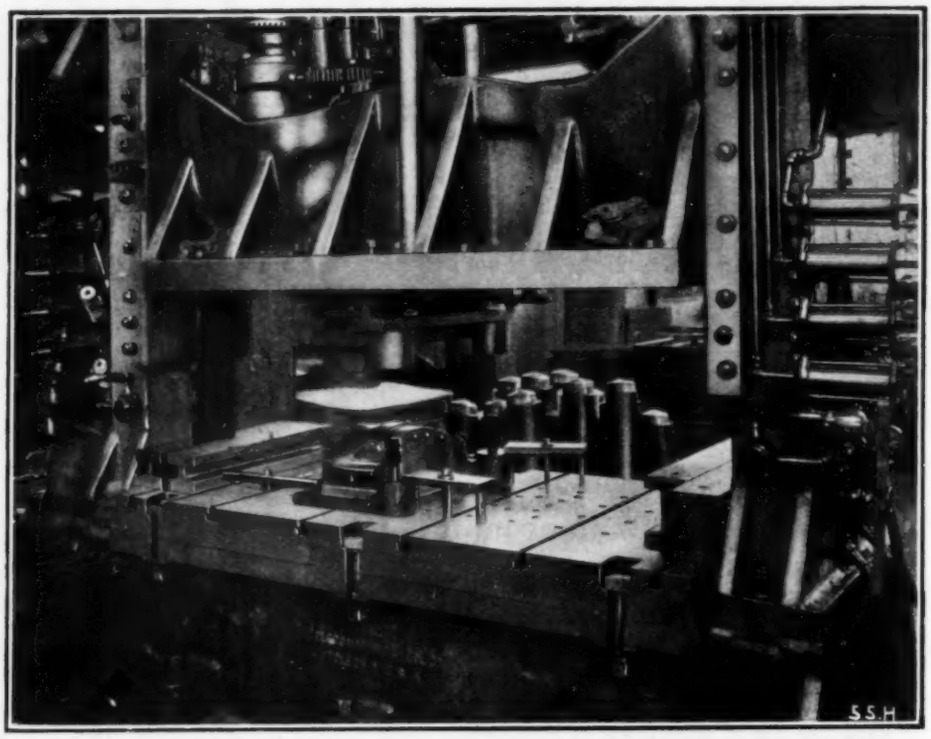


Fig. 4 (above)—A set of pillar-press dies for small parts

Fig. 5 (below)—General view of the press shop of the Hupp Motor Car Corporation

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Naturally, however, one associates fenders and drip pans and the like with pressed steel work, and Fig. 3 shows a typical set of fender dies in a large Toledo press. A set of pillar-press dies is shown in Fig. 4 for one of the small parts of the car.

It is the custom of the designing engineer today to consider first whether the part can possibly be made of pressed steel before he takes up the question of other materials. Ten years ago the stamping of parts was looked upon as the art of the specialist exclusively but today many automobile shops are putting in their own presses and equipment. One of the very recent examples is shown in Fig. 5, representing the press shop of the Hupp Motor Car Corporation. In this shop are manufactured the parts mentioned in this article as well as gasoline tanks and simlar pieces.

Motor Shop Problems

More About Cylinder Bores—Connecting Rod Bearings

By Frank C. Hudson

AS WITH all other shop problems there is a difference of opinion both as to the reaming of cylinders, and concerning the methods of honing cylinders. Some shops take two cuts with boring bars and then grind. Others think three cuts better, the last cut being light and leaving less work for the grinding wheel and spindle. In other shops, they ream before grinding although this is not very common.

Where the cylinders are not ground there is a difference of opinion, both as to whether to ream once or twice, and as to how much to leave for the reamer to remove. Many seem to feel that it is best to leave from 0.010 to 0.012 in. for reaming in order to give the cutting edges a chance to get hold of the metal. Some, however, consider it necessary to leave only 0.006 to 0.008 in. for reaming. These shops usually run three boring bars through the cylinders and then merely scrape out a few thousandths before the honing process.

The usual honing method is to rotate the hones quite slowly and to pass them through the cylinder bore at a much higher rate. A rotating speed of from 10 to 15 r.p.m. and a reciprocating speed of from 100 to 130 strokes per minute is fairly common practice.

In one shop at least, this method is reversed and the hones are rotated at approximately 100 r.p.m. and reciprocated at from 10 to 15 strokes per minute. Materially different results so far as either the quality of the work or the rate of production is not claimed for this method. It has been the experience, however, that the hones, or more properly the hone holders, give less trouble when this procedure is followed. It has been found that the sudden reversal of the hones in order to get the larger number of strokes per minute, tends to loosen the abrasive blocks in the holders and to wear the connections that drive them. The slower reversal due to the fewer number of strokes per minute seems to obviate this.

The results, so far as quality of work is concerned, are given as approximately the same. With abrasive blocks of 150 grit, about 0.001 in. is removed in from 1 to 1½ min. so that about 30 cylinder blocks per hour can be counted on as the output per machine. This of course depends somewhat on the weight of the block, since the handling time increases with the weight unless the honing operation is in the conveyor line so that the blocks roll into place and can be easily sent on their way to the next station.

The handling of parts is, incidentally, a very vital factor in the total cost of any piece. It frequently happens that the machining time is a small part of the total cost.

Connecting Rod Bearings

Connecting rod crankpin bearings are the subject of considerable discussion in many shops. Ford has consistently stuck to the bearing cast in the rod, using the die cast method of forcing the metal into place so as to secure a density that gives good wearing qualities. The wearing qualities of these rods, with splash lubrication and no oil scoop or even oil hole, is too well known to need discussion.

Many so-called high grade engines have used separate bearing bushings, usually of die cast babbitt in a bronze shell backing. Some use just a die cast babbitt without the brass back. But even some of the quality cars are now using the bearing cast in the rod, either by the centrifugal process or by some form of die casting. And this in spite of the fact that users are demanding and getting more and more service from engines. Better bearings and better oiling systems are giving engines that run for thousands of miles without appreciable wear, and without the necessity of taking up bearings nearly as frequently as formerly. The improvement in the quality of automobile engines has nowhere been more apparent than in the crankshaft and piston pin bearings.

Piston or wrist pins for example have reached a state of perfection that was unbelievable a few years ago. In many cases a tolerance of "two-tenths" is regularly adhered to, even on engines that do not rank in the high price class. The advent of the centerless grinder and the lapping machine have almost revolutionized shop practice in this field and gives us piston pins that hold their size better than anything we have ever had before. Considering the temperature ranges to which piston pins are subjected, from zero to worse, in a cold garage to a long hard drive of several hours, it is amazing that we do not experience much more trouble from them than we do. Add to this the more or less uncertain lubrication under varying conditions and we must take off our hats to the design and workmanship of a vital part that gives so little trouble.

Much thought has been given to the piston pin problem and pins have been designed that will automatically take up the difference in expansion between the steel, the pin, and the material of which the piston is made. One man combines aluminum center with a split steel shell for the bearing surface. Other designers have made adjustable pin bushings, to allow taking them up without removing the piston from the cylinder. Making the proper adjustment without the "feel" of the fit, seems a bit difficult.

Book Reviews

John Edson Sweet. By Albert W. Smith, Dean Emeritus of Sibley College of Mechanical Engineering, Cornell University. Two hundred fourteen pages, 6x8¼ in. Illustrated. Published by the American Society of Mechanical Engineers, 29 West 39th St., New York City. Price, cloth boards, $3.75; half morocco, $7.50.

In writing this book, the author has undertaken a difficult task. Those who knew Professor Sweet will realize the almost hopelessness of attempting to give the reader an adequate insight to the genial, lovable character of the man.

To older engineers, Professor Sweet's name was a symbol of all that was sound and good—to younger engineers it is but a memory—to "his boys" it is a memory to be cherished.

The book will bring before the public the events of a life and a period that have passed, and it will help tie the old and the new eras together. The fine, strong personality of the subject and his influence for good upon all who came into intimate contact with him, are well portrayed. The book contains many good stories showing the deep thinking and fine sense of humor possessed by Professor Sweet.

The book will be of interest to the layman as well as to the engineer, and the author is to be congratulated for the way he has handled his subject. His work may rightly be termed an unusual book about an unusual man.

Inventory Practice and Material Control. By Frederic W. Kilduff. Four hundred thirty-seven pages, 6x9-in., cloth boards. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York. Price $5.

The author has divided this book into two sections as indicated by the title. In the first section, methods are given so that a constant control of materials can be obtained throughout an inventory period, which lessens the possibility of having too great a part of capital tied up in unfinished material. The retail method of inventory which has received the approval of tax authorities, is taken up in detail. Many branches of inventory are dealt with, pointing out details that are many times overlooked by concerns requiring inventories.

The second part contains chapters in connection with material control, including purchasing, receiving, storing, issuing and shipping. Methods of obtaining inventories from material ledgers and material control systems are shown.

The subject of inventories is very well covered from an accounting standpoint and the information contained will be of value to those who have the perplexing problem of taking inventories.

The Composition of Technical Papers. By Homer Andrew Watt, Professor of English, and Philip B. McDonald, Assistant Professor of English, New York University. 429 pages, 5x7¼ in., clothboard covers. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price $2.

The book is the second edition of the original text, added to and revised as a result of experience gained since its initial publication. It is intended for use in the engineering class room to develop and direct the student in the essentials of imparting his technical knowledge to others in an understandable manner. Its fund of information can profitably be used by many engineers in the field who desire to improve their position.

An introduction, in the first of the two main parts of the text, discusses the handicap to the engineer who is unable to write lucidly and defines the types of writing in which he is concerned. This is followed by chapters on fundamental problems and suggestions, principles involved in the whole composition, the paragraph, the sentence, diction and professional style.

The second part deals with types of technical exposition and is divided into chapters containing numerous sample excerpts, by way of practical illustration, on the points made under the headings of technical description, exposition of processes and of ideas, engineers reports and business and professional letters. The last chapter, the campaign for better letters, is new and contains suggestions based on present-day successful practice.

The presentation throughout the book follows, closely, the principles advocated in the text making it easily understandable, instructive and interesting.

Corrosion-Resistant, Heat-Resistant and Electrical-Resistant Alloys. By the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Two hundred sixty-nine pages, 6x9-in., paper covered. Price single copies $2, in lots of 10 to 25, $1.75 each, in lots of 25 to 50, $1.65 each, and in lots over 50, $1.50 each.

This pamphlet is a reprint of 13 papers and discussions presented at the last annual meeting of the American Society for Testing Materials. Many valuable data are given on corrosion-, heat- and electrical-resistant alloys which will act as a handy reference for those using such alloy materials for engineering, commercial and domestic purposes.

Three inserted tables are given, compiled from data furnished by thirty-two companies manufacturing these alloys. Information is included on composition, machining, forging and welding qualities, mechanical properties at normal and elevated temperatures, and thermal, electrical and corrosion-resistant properties. These data give the prospective user a broad survey of the field from which he may select metals for a specific purpose.

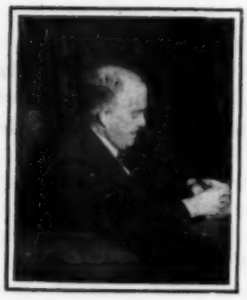
Charts, tables and illustrations are given in the various discussions together with results of the tests made for the various determinations. Many of the data will be of benefit to the future progress of alloy metals.

Summa Cum Laude

The favorite toastmaster's quip at Washington dinners of explaining, when Herbert Hoover is not among the guests, that the Secretary of Commerce is away at some university taking his 250th honorary LL.D., was recently supplemented with data more exact in detail. It appears that the former Food Administrator has an honorary LL.D. or PH.D. from 18 American universities.

A speaker at a dinner recently informed his astonished listeners that Dr. Hoover had more degrees than eight Al Smiths, four George Harveys, seven William Jennings Bryans, ten McAdoos, four Judge Garys, two and one-half John W. Davises, ten Otto Kahns and twenty La Follettes; and as many as any two university presidents in the world.—*Barron's.*

Motions and the Variable Factors that Affect Them



Last photograph of Frank B. Gilbreth, taken by John Younger

Lillian M. Gilbreth, who is carrying on the work of Gilbreth, Inc.

By K. H. Condit
Editor, *American Machinist*

How motion study was discovered—The origin of the slogan, "The one best way to do work"—The three types of variables that affect motions and workers

THE last interview I had with Frank B. Gilbreth was perhaps the most interesting of the many talks we enjoyed while the material was being gathered for the articles describing his work. In the course of it we got to the subject of motion study, probably the most important of his contributions to the Science of Management. There was not the slightest warning then that his work was to be cut off so abruptly by death. Up to that time my attempt to describe it had been a story of a constantly changing and growing system of management. Now that he is gone it takes on a different significance as a chronicle of the thoughts of one of the great engineers of his day.

As a youth Mr. Gilbreth was headed for the Massachusetts Institute of Technology when he finished high school. Before he could matriculate, however, a chance to get into building construction work with a friend changed his plans. He went in with the understanding that a good job awaited him as soon as he mastered one trade and understood the others. How successful he was may be judged from the fact that at twenty he was superintendent in charge of the construction of an important building and then went steadily ahead until he had as many as ten thousand men in his employ.

With that work we are not particularly concerned but it provides a background for the discovery of the basic principles of motion study. The trade that Frank Gilbreth elected to master was that of the bricklayer. As an apprentice he took his stand between two journeymen, burning to learn as fast as possible so that he could graduate from the unskilled labor class and rise in his friends' opinion.

Progress was not very satisfactory to the impatient novice. He attempted to copy the way in which the man at his right went through the motions of laying brick. The expert was entirely willing to teach the beginner and patiently showed him just how each motion was made. It looked easy enough but somehow or other the motions he acquired did not seem to be just like those of his teacher when the latter was working along without thought of his neighbors.

The novice got discouraged and concluded that the only way he could ever fool the foreman into thinking that he was a real bricklayer was by copying the motions as well as he could. He thought about the reasons for his clumsiness most of the time and watched his teacher more and more carefully. He was thoroughly convinced that the secret of success lay in practicing the correct motions until they became automatic but the difficulty lay in determining just what were the correct motions to use.

He had discovered by this time that the motions used by the journeyman while trying to teach him to lay brick were quite different from the motions used in the regular course of the work. Then he suddenly noticed that the man used a set of motions while he was working slowly different from those employed when he was in a hurry. And both sets differed from the set he used when teaching. Here were three different

OVER a period of two years there have appeared in the *American Machinist*, from time to time, articles describing the carefully thought out management methods devised and employed by the late Frank B. Gilbreth. Considerable difficulty in securing the data for these articles was encountered because of the large amount of traveling Mr. Gilbreth had to do. The material for this article was obtained from Mr. Gilbreth shortly before his death. Fortunately his ideas do not pass with him as his wife, Lillian M. Gilbreth, was his partner in business for twenty years. She has consented to assist in the preparation of the articles that must be written to complete the story of his work and it will therefore be possible to finish it.

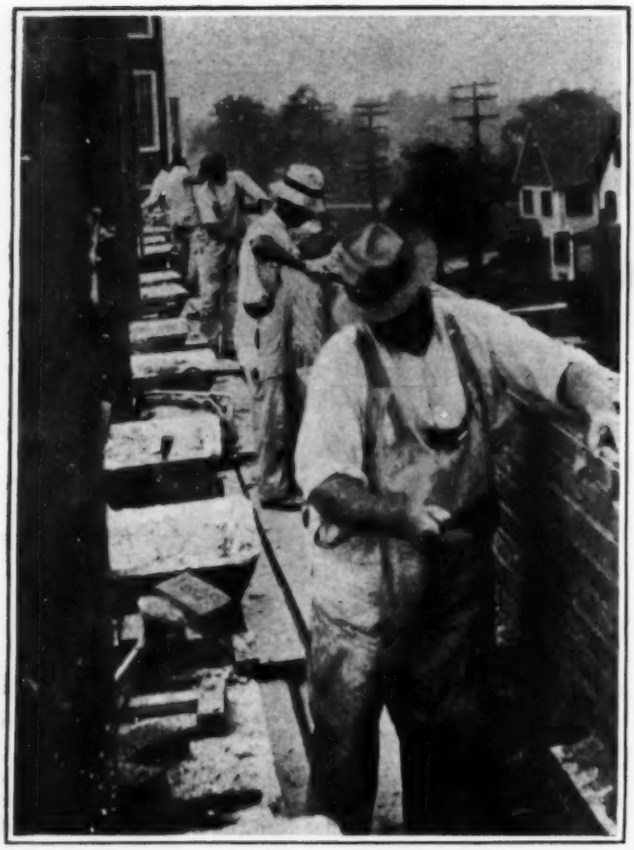


Fig. 1—Bricklayers working with bricks and mortar so supplied that they do not have to stoop

sets of motions for doing the same job. Which was the best set?

It occurred to young Gilbreth that he could solve the problem by watching the man on the other side of him and comparing his motions with those of the other master craftsman. Much to his amazement he found that expert number two also had three sets of motions but that they were all different from those used by his first teacher. It was just at this point that the first idea of motion study was conceived. There must be one set of motions better than all the rest. Why was it not used all the time and why did not every expert bricklayer know and use it?

The more he thought about it the more convinced he became that the discovery of the one best set of motions and the acquirement of automaticity in their use meant a mastery of the bricklayer's trade greater than that possessed by any of the workmen he knew. He discussed it with everyone that would listen. They laughed at the idea as men have always laughed at innovations but time has proved the soundness of it and it has been applied to accomplish almost unbelievable economies in plants of many kinds. By its use champion typists have been developed; the time needed for assembling carbureters in a big automobile plant has been reduced by eighty per cent; three and even four times as many bricks have been laid in a day.

Eventually the idea crystallized into a slogan, "The One Best Way to Do Work." Mr. Gilbreth, his wife and partner, and the engineers they employed, have made it their business to discover the "One Best Way" for every job and teach it to those doing the job. They have met obstinate resistance on the part of many people who did not fully understand what they were doing. Perhaps the most reasonable objection was based on the mistaken belief that a best method, once discovered, was never changed. It is true that because of the care and thought taken in establishing a method it is likely to be in use for some time without change but the Gilbreths always made provision for changes whenever they were needed or desirable.

Note that in all of his early work Mr. Gilbreth never once thought of the time element as the most important item. It did not occur to him to employ a stop watch. In any event the stop watch would have been of little use to him for the reason that the motions and subdivisions of motions he was recording and analyzing were too brief for stop watch record. All of his thought in these early days was given to finding out the best ways of performing various jobs, teaching others how to use them and advancing himself as rapidly as possible in his own work.

For many years there has been a ceaseless war between Mr. Gilbreth and the exponents of stop-watch time study. It is not the function of these articles to

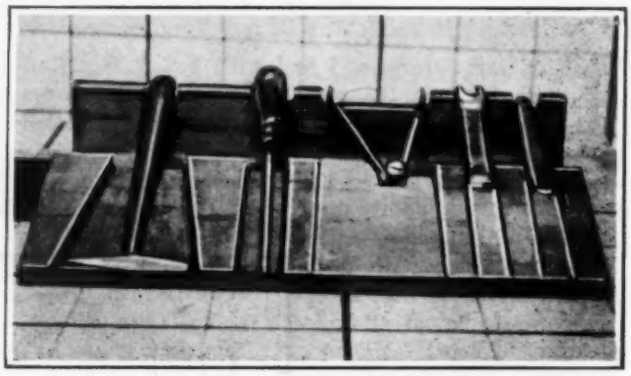


Fig. 2—A toolrack arranged to make it easy to pick up the tool wanted

enter into the discussion of the relative merits of time study and motion study. The archives of the Taylor Society, the American Society of Mechanical Engineers and the Society of Industrial Engineers will yield much argument and discussion of the case. A few events that are now history will shed some light, however.

During the early nineties the word began to go around that the men working for Frank B. Gilbreth, particularly the bricklayers, Fig. 1, were setting up some unusual records of performance. In 1896, Sanford E. Thompson asked permission to observe the workmen on one of the Gilbreth jobs, "in the interest of science." He was given every facility. The men thinking he might be an inspector worked a little faster than usual.

Five years later Mr. Thompson submitted a manuscript on time study of building operations. This was the first intimation Mr. Gilbreth had that his men had been time-studied. Mr. Thompson had used a stopwatch book with two watches. Mr. Gilbreth promptly condemned the manuscript as worthless because he thought it was an attempt to measure accurately and he knew that no stopwatch would give readings close enough for such a purpose. The ethics of secret time study did not enter into the case.

Some time later, in 1903, Thompson in collaboration with Frederick W. Taylor made the statement that Gilbreth's men worked seventy-five per cent faster than

the men employed by any other contractor. It was not until 1907 that Mr. Gilbreth fully understood what Thompson had been trying to do. He then told Mr. Taylor, whom he had just met, that such time study was valueless because it was not a record of work of the best man procurable. He also said that the motions should be right before any attempt was made to time them. This was a new thought to Mr. Taylor who had been working solely with the time element, but after a little consideration he readily admitted its soundness.

Mr. Taylor was so impressed with the motion study idea that he invited Mr. Gilbreth to be co-author with him and Mr. Thompson of a book on time and motion study. As Gilbreth could see nothing in the time study idea he declined. His own book on motion study was published in 1910 as a serial in *Industrial Engineering*. It was brought out in book form in 1911.

So much for the history of motion study. It has been set down in the hope that those who read it will grasp the simplicity of the principles and undertake elementary motion study on their own account. Analyze some of the jobs you perform daily and you will be surprised at the number of unnecessary motions you make. The Gilbreths have gone far in the study of motions but they started in the same simple way and took pains to make a careful record of their discoveries.

Mr. Gilbreth's work led him to believe that every motion made by a workman is affected by certain variables that must be studied. In his first book on motion study he divided the variables into three classes: those of the worker, those of the surroundings and those of the motion itself.

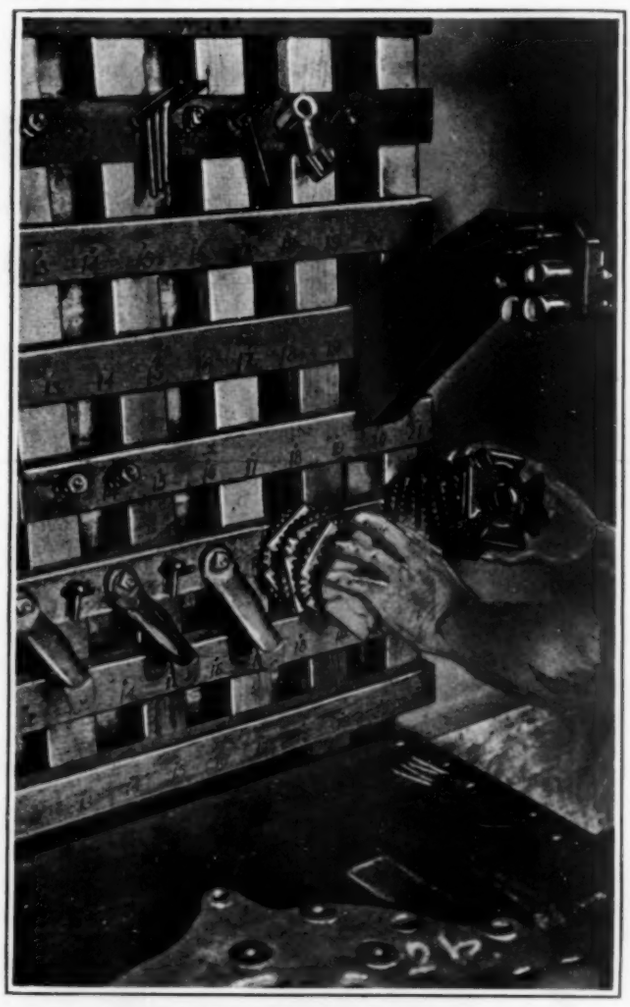


Fig. 3—An assembly rack with parts mounted on hooks so that they are accessible to the assembler. A boy loads the rack

In the first class will be found such factors as anatomy, mode of living, health, temperament, contentment, experience, skill, earning power, etc. It is difficult to draw the line where one ends and the next begins, but it is not important to do so because the main object is to be sure that no variable has been overlooked.

Here are a few examples to show what is involved in the study of the worker's variables. As to anatomy it is obvious that the left-handed worker will have to reverse the motion of the right-handed one. If he is too short to reach the work he needs something to stand on.

Is it necessary to dwell on the fact that the contented worker is more efficient and easier to get along with than the discontented one? He is also easier to convince that a habitual motion should be discarded for a better one.

Experience vs. Skill

Experience is likely to mean that old habits, usually wrong, are firmly fixed and difficult to change. Skill, on the other hand, implies exceptional muscular control and hence a ready adaptability to new methods.

A man's health and his mode of living are often interdependent. If neither is all that it should be his efficiency must suffer. Temperament, also, must be considered. The expert workman often feels insulted if he is put on a job that requires less skill than his usual one. Some men like to vary their work, others prefer to stick at one thing until their motions become so nearly automatic that they can think about something else, or about nothing at all.

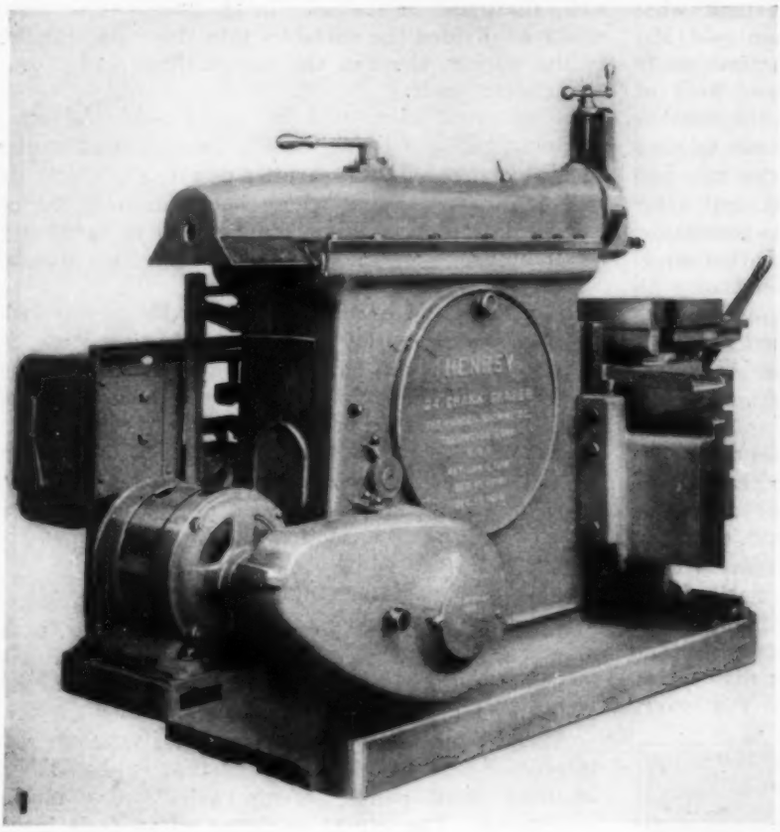
The variables of the surroundings will include: appliances, clothes, colors, entertainment, temperature, lighting, quality of material, incentive, tools, union rules, size and weight of unit moved.

Most of these variables have received much closer study of recent years than was the case when Mr. Gilbreth's book appeared but there is still much to be done. We know a lot about lighting, for example, but not all there is to know. And there are still many shops where material control is a farce, or even nonexistent. Some thought has been given to providing the right tools but many a good workman is still handicapped by being forced to work with inferior tools. As to union rules, we don't seem to have progressed very far. Certain trades limit individual production, others are always bickering over "jurisdiction."

Two efforts to standardize variables of the surroundings are shown in Figs. 2 and 3. One shows a standard tool rack, the other an assembling rack.

Finally there are the variables of the motion itself and they will be put down as they appeared in the first motion study book. Acceleration, automaticity, combination with other motions and sequence, cost, direction, effectiveness, foot-pounds of work accomplished, inertia and momentum overcome, length, necessity, path, "play for position," speed.

Here is a subject big enough to stagger the most enthusiastic investigator. Mr. Gilbreth frankly admitted that he could do little more than scratch the surface. But he made quite a scratch and his method of attack will be the subject of a later article.



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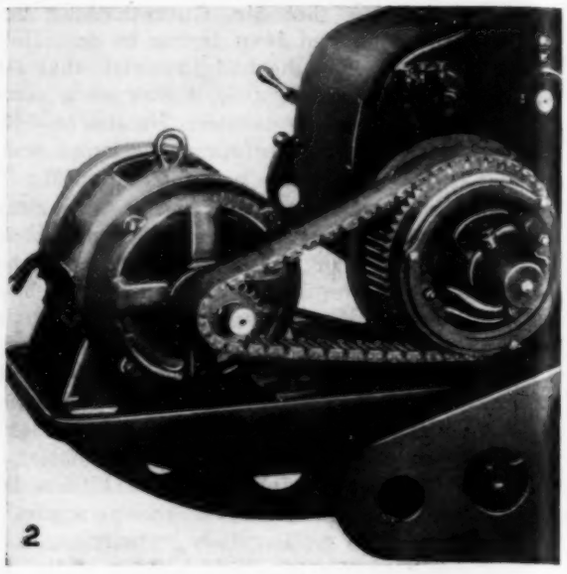


2

Modern Methods of

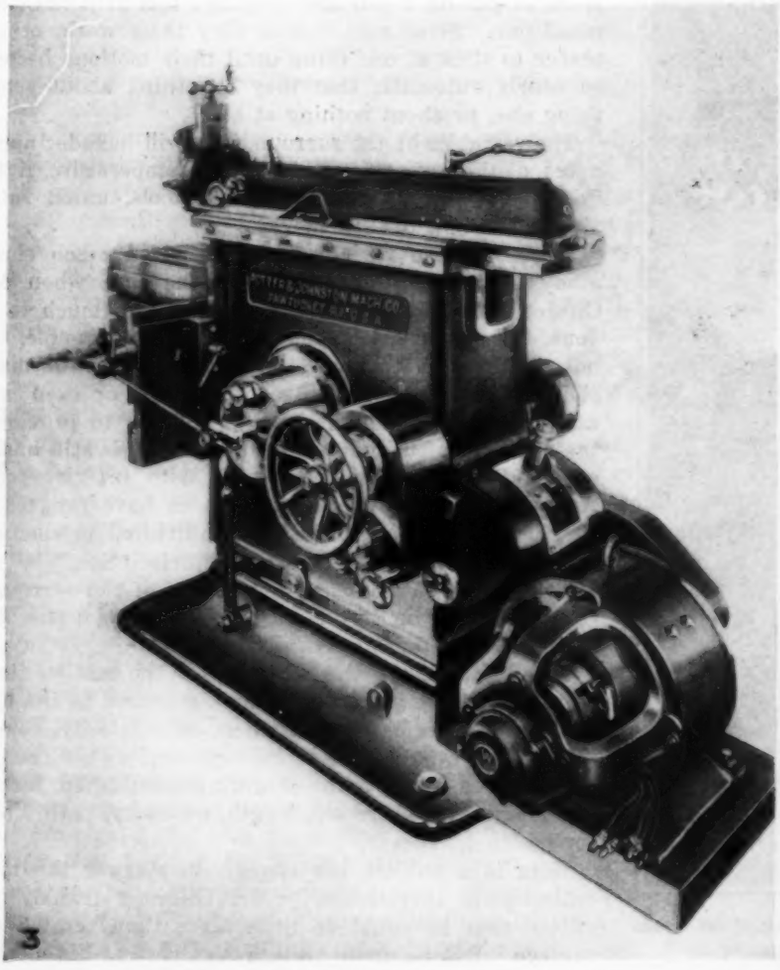
Shapers

1—Hendey Machine Co.—silent chain drive

2—Ohio Machine Tool Co.—silent chain drive

3—Potter & Johnston Machine Co.—silent chain drive

4—Ohio Machine Tool Co.—geared drive



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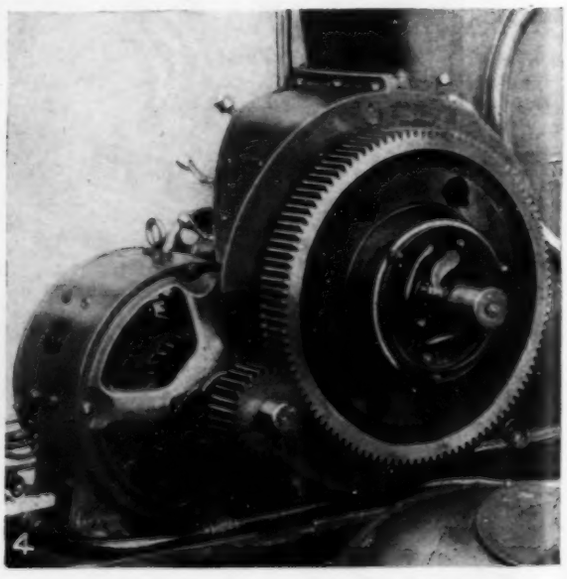

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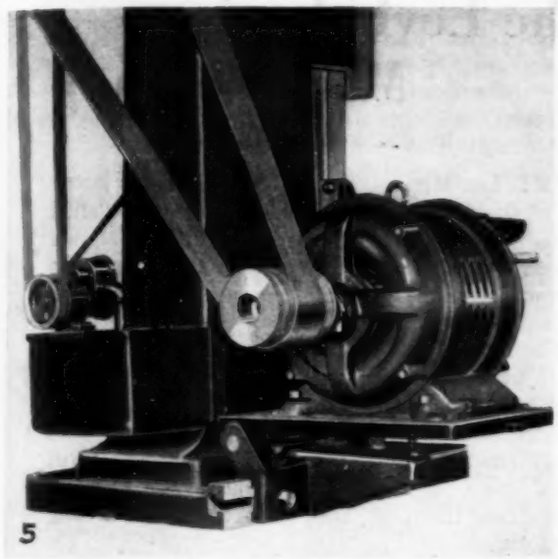

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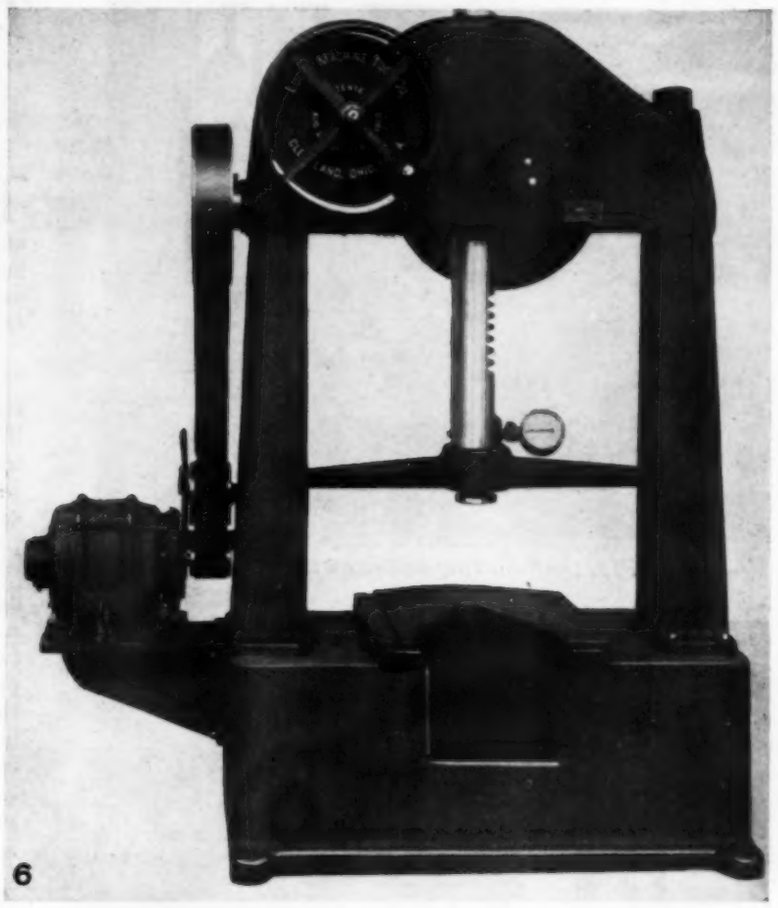

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Mounting Motors

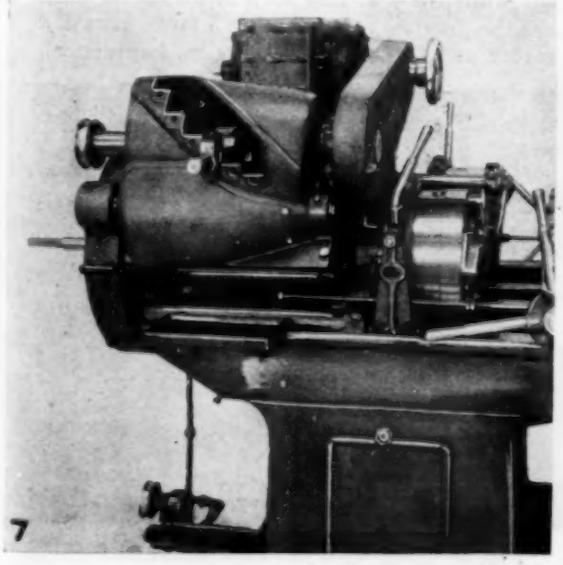
Various Machines

5—Minster drilling machine — adjustable for belt tension

6—Lucas forcing press uses idler

7—Landis Machine Co.—variable speed motor

8—Davenport automatic — motor supported under machine



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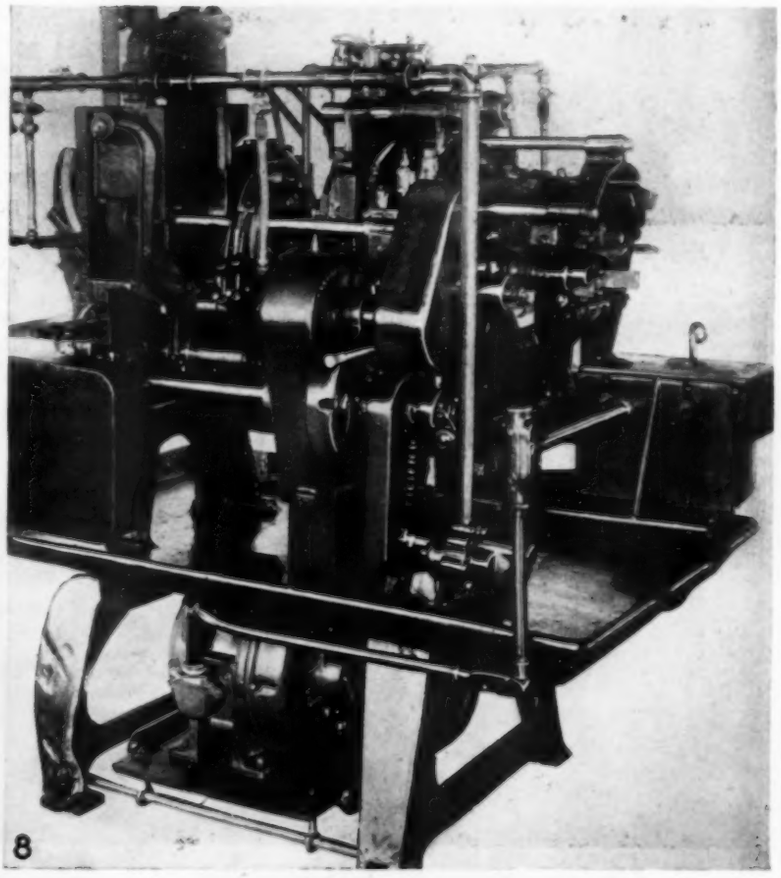

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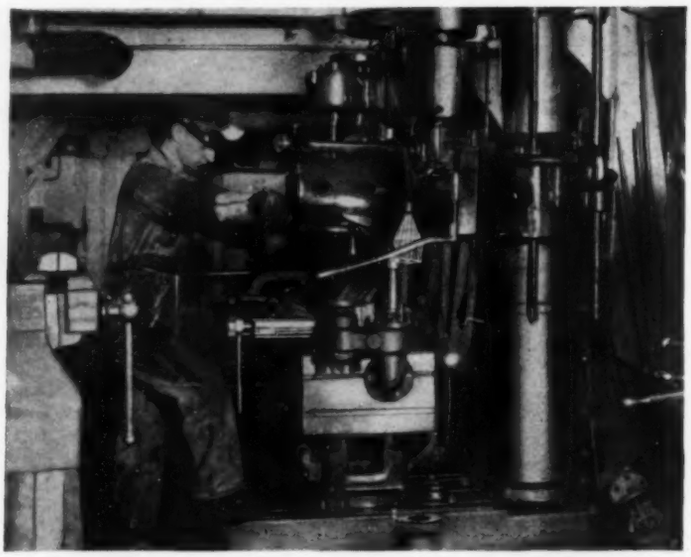


Fig. 1—Reseating valves on a radial

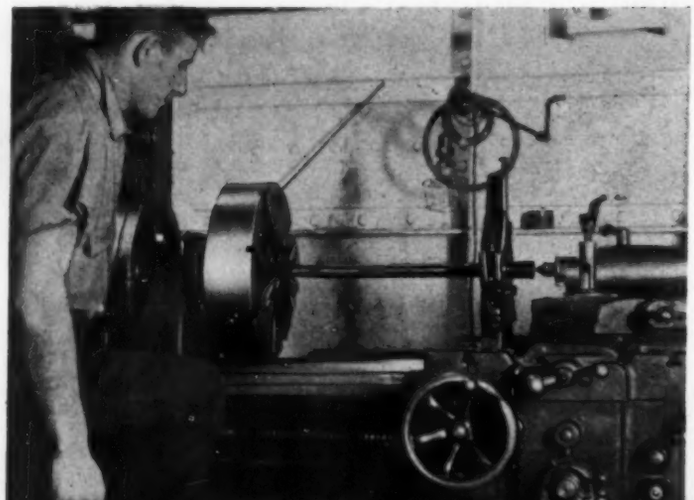


Fig. 2—Finishing a piston rod for blower engine

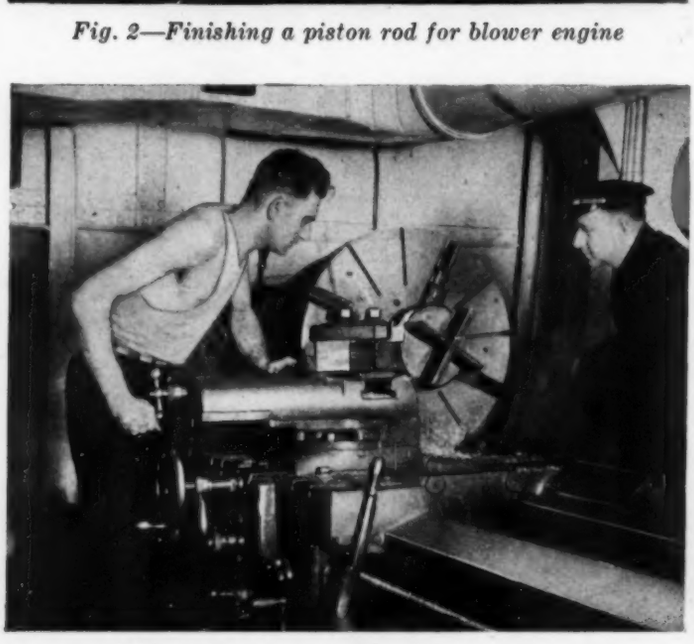


Fig. 3—Turning a new main stop-valve

The Leviathan's Machine Shop

By Crete Hutchinson

THE Leviathan is again in service and some of the jobs that her machine shop was called on to do as part of the overhauling are shown herewith. Incidentally some of the jobs are also part of the running repairs necessary to keep her in commission.

When she was interned, the German owners had a small shop fitted with crude and inadequate machines, located on the starboard side just off the main engine-room working platform and sandwiched in with some ice machines. But when she was refitted, a modern shop was installed on the port side just off the working platform.

This equipment has individual electric drive and consists of 3 lathes—16, 18 and 32 in., a radial drill, a large shaper, a grinding stand with two wheels, a power saw, a small, sensitive drill-press and a Davis-Bournonville welding and cutting torch. While all classes of work are done here, it would hardly be the place for a man educated in a modern production shop, as very frequently the shaper will be called into service as a gear cutter, the radial drill as a boring mill, and so forth.

The shop and men are under the direct supervision of W. J. Condon, staff chief engineer, but the actual work is carried out under the shop foreman, P. Miller, a versatile young man who has charge of four machine hands and what helpers are necessary.

Rough castings of the parts most frequently needed are carried in stock and machined as wanted. A vast amount of valve work is necessary and during the overhauling period there is a constant stream of valves, disks, stems and glands going in and coming out of the shop. The fact that a valve disk may be worn until it is beyond repair while the seat has worn large in the bore, makes the practice of machining a large quantity of repair parts to one standard size, impractical.

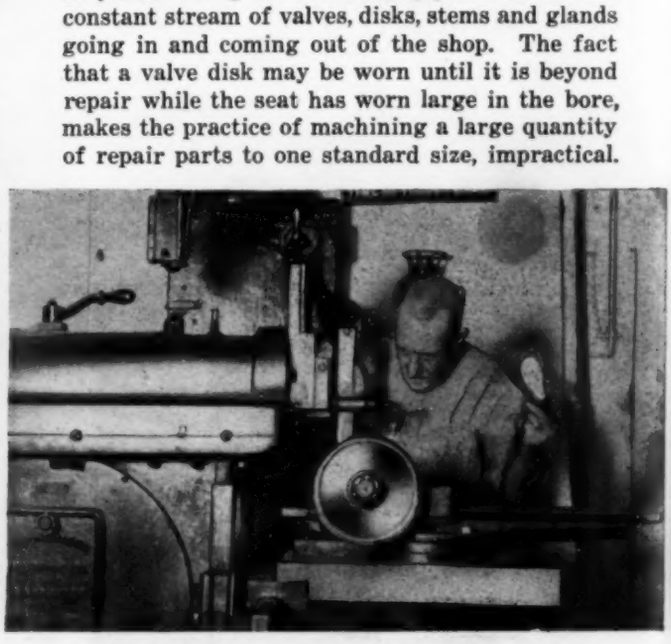


Fig. 4—Shaping a flat on a piston rod

This year, during the usual winter layup, all of the machine work necessary was done on board. There are 138 safety valves on the boilers, 92 feed, stop and check valves, 138 top and bottom blow valves and 92 main and auxiliary stop-valves. This does not include the many water-column fittings, test cocks, salinometer cocks, drain valves, cutouts, riser valves, expansion heaters, strainers and so on. Everyone of these fittings were taken apart to be ground, and machined if necessary, the engineers doing all of the outside work.

In the engine rooms there are 18 feed pumps and 2 compound reciprocating engines that drive the circulators, that had to be taken down, be reconditioned and reassembled. Every part had to be thoroughly cleaned and reassembled down to its last delicate part. A few weeks ago the pipe lines were down and strewn about; the innermost parts of engines, turbines, air compressors, pumps, generators and giant castings were on the floor. The upper casings were raised from the great turbines, the floor plates removed and scantlings laid in their places. A young army of very greasy young men in overalls and old uniform caps, all busy with their own particular problems, moved about without confusion.

The machine shop is about fifteen feet below the water line, but many 200-watt Mazda lamps in ceiling fixtures, with portable hand lamps for the machines, make it a bright cheerful workroom. The licensed engineers who stand the watches in the engine and fire rooms when at sea, become machinists when in port. They repair the breaks and correct the defects, and are all under the command of J. J. Fagin, chief engineer.

While the regular machinists have nothing to do with the operating of the ship at sea, their duties are similar to that of a man in the same sort of a job ashore, and the compensation is better than for the same class of work ashore. At sea they receive their board and lodging as well as a substantial salary, and have none of the incidental expenses of the shore man, unless, of course, there is a family to maintain at home. There are only five regular machinists on the Leviathan and fewer on the smaller ships of the same line, so the field is not a large one.

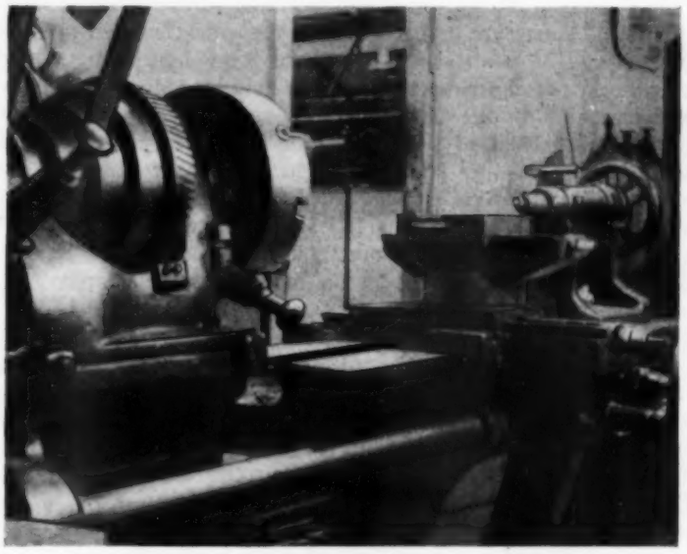


Fig. 5—The German lathe in the old shop

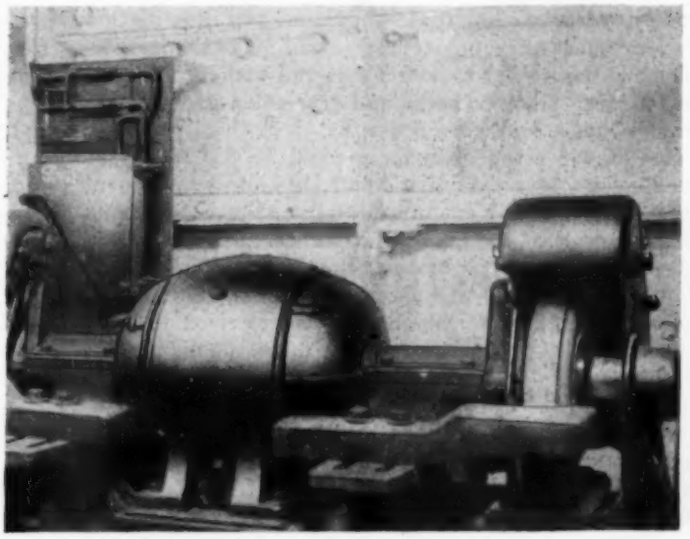


Fig. 6—Double-wheel grinding stand

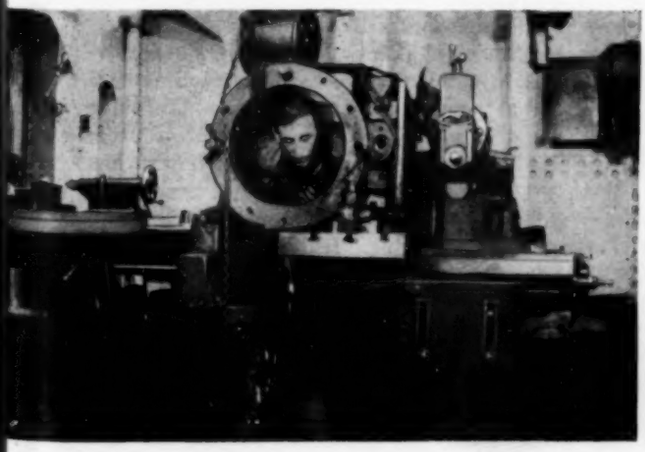


Fig. 7—Ice-machine cylinder to be faced

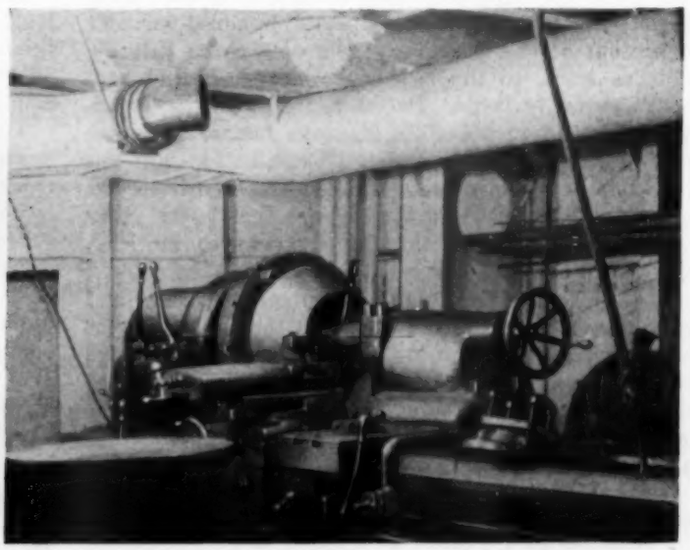


Fig. 8—Bronze form for clay fire-rings

Protecting the Workers' Health

THAT American industry leads the world in protecting the health of its workers is evident from the great forward strides made in the field by industrial establishments in the United States, as reflected in a survey of the cost of health service in industry now being made by the National Industrial Conference Board, 247 Park Ave., New York City. According to the Board's investigation, as far as completed, on the average about 16 per cent more money per employee is now being spent by industry on medical supervision than was being spent four years ago, when a similar survey was made by the Board.

Industry values the health of its workers. Talk to a man who has been in the army, and he will tell you that at no time of his life was his general health more scrupulously looked after than while in the service. Likewise, employers are concerned over the well being of their employees, to a degree where the question might well be raised whether if, in an up-to-date industrial plant, the worker's physical well being often is not better protected than it is in his home or wherever he may spend his leisure time. Care is taken in every modern establishment that ventilation and illumination are as perfect as technical science can make them, so as to enable the worker to do his best and without unnecessary strain. Shower baths and recreation grounds are provided more and more generally.

Out of 446 establishments covered by the survey of the Board, 255 report that applicants for employment are being physically examined, and most of these plants use the result of the medical examination as a guide in selecting the proper work for the applicant. In many plants, employees as well as executives, are re-examined at regular intervals. Much care is exercised to safeguard workers from contact with infectious diseases.

Conserving Productive Power

Much possible damage to health and the productive capacity of both, the individual worker himself as well as the productive power of the nation at large, is obviated by physical examinations. Naturally, not all applicants for work are in perfect health. Many have minor ailments that can be corrected, but are not known to them until they are examined when asking for work. This often results in making a sound, hundred per cent worker out of one previously able only to do little or mediocre work, to the loss of both himself and productive power at large. Defective teeth, tonsils, defective vision and curable skin diseases, for instance, are cases in point. Again, physical examination will uncover some chronic defects which do not entirely bar the applicant from work, but require that he be given a specific kind of work that he can do with the least injury to himself. Arrested or cured tuberculosis, varicose veins, flat feet, high blood pressure, kidney and heart disease are in this class. Other defects, not always known to the worker himself, such as defective eyesight, defective hearing, or heart trouble might well present danger to the safety of other workers and the plant if the worker is placed on a job apt to place strain on the organs involved.

Physical examinations, therefore, are an insurance and protection, both to all workers and the industrial establishment as a whole. As a result of such examinations, many men and women suffering from some defect, who otherwise might not have been able to hold a job, or only a poorer job, are enabled to hold good jobs where their particular affliction does not interfere with their work. The survey of the Conference Board, as far as completed, indicates increasing employment of such "sub-standard" workers, which is equivalent to a fuller utilization of the available productive power of the nation, and means a livelihood for many a man or woman who otherwise would be dependent on others.

Health in the Home

Besides the care taken of employees in accidents, many industrial plants give what aid they can in case of sickness, with a view to cutting short the period of illness and returning the worker to his job as soon as possible. In this connection visiting nurses are often used to watch over the progress of the patient, although generally medical attention during illness not contracted through his work, of course, is a personal matter for the employee to procure.

Objections to physical examination by employees and applicants for work are practically nil, the Board's investigation indicates.

Only 11 plants had discontinued the policy of medical examination out of the 446 included in the survey.

In 501 plants replying to the Board's questionnaire, the following personnel was engaged in looking after the physical welfare of the workers: 265 full-time physicians, 356 part-time physicians, 773 physicians on call; 13 full-time dentists, 78 part-time dentists; 152 male nurses, 693 female nurses, and 121 visiting nurses; the medical staff included 256 technical assistants and 361 clerical assistants.

The Board's investigation as far as completed, indicates increasing thoroughness of physical examinations of the workers, and that the general policy of the industries is to extend medical supervision into the fields of sanitation, safety, general welfare, home visitation, health education, and related matters.

What Is a Used Machine Tool Worth? —Discussion

By Rhodes Polleys

The method of determining the value of used machine tools as outlined in an article by Martin H. Ball under the title given above, and published on page 228, Vol. 62, of the *American Machinist*, presented an interesting solution of the problem.

The fixed percentage method of writing off machine depreciation has its good points but at the same time it works a gross injustice on the careful machine tool owner. Suppose as owner of a machine shop, you have taken care that the machine tools were not abused. Perhaps the reader is one of those fussy men who has seen to it that the lathe bed has been kept free from unnecessary chips, or that bearings were not neglected when the oiler made his rounds. It doesn't seem reasonable that the law of depreciation should hit such owners to the same extent as it does those who abuse machinery.

A fixed table of yearly depreciation is a splendid thing to determine the approximate value of a machine tool, but it should be supplemented by an additional factor that would make due allowance for the use and care the machine has had.

How to Estimate Machine Shop Costs

By Albert A. Dowd

Drafting costs can be estimated—The four main divisions —Preliminary freehand sketches of the design—Examples of flat rate estimates—The contingency per cent allowance

THE fundamental principle of estimating, by dividing and reducing the problem to its simplest subdivisions, will apply no matter what the nature of the work may be. To discuss the problem of estimating drafting costs, therefore, it is only necessary to consider in detail the four main divisions of the general subject. These are designing, detailing, checking, and changing with the factor of contingencies which may be allotted by divisions or over all as a whole.

The allowance for design should include preliminary sketching, general discussion and conferences regarding the design, and the possibility of a complete change in the design of units which may be found necessary during the progress of the design. In jig or fixture estimating it is sometimes necessary to include preliminary planning and laying out of the operations unless an operation sheet has been furnished with the part drawing. Allowances should be made for these items when necessary in proportion to the amount of labor involved.

Assume that a jig or fixture estimate for a piece of work like that shown in Fig. 81 is required and consider a fixture for milling the slot *A* in this piece. Assume, further, that an operation sheet showing the sequence of operations has previously been prepared, specifying that base *B* has been milled, hole *C* reamed, and the other holes *D* drilled. Then for the milling operation the base *B* could be used to set the work on and the piece could be located by a stud in hole *C*, or in one of the holes *D*, or by stops against one side of the work. Having decided on a method, a sketch, Fig. 82, should be made. This sketch might be made freehand or it could be laid out quickly on a reduced scale.

The Freehand Sketch as a Basis

The freehand method is most commonly used but it is advisable to make the sketch so that it will closely approximate scale dimensions. Unless this is done a good idea of the space covered by the finished drawing will not be obtained and as a consequence the drafting estimate is likely to fall below the real time needed. With this sketch as a basis, the time can be estimated by an experienced man. It is obviously necessary, however, to know the class of workmen employed and about what production can be expected of them.

A form is seldom used for a drafting estimate. The figures are generally put on plain paper in connection with the estimate on building the tools. It is common practice in some shops to make jig and fixture drawings on detail paper and after varnishing them to send them into the shop to work from. This process is not to be commended as the drawings become easily soiled or mutilated so they are not of much use for future reference. It is much better to make them on good bond paper suitable for blue printing, and send the prints into the shop.

As a basis for discussion consider the freehand sketch of the fixture shown in Fig. 82. The time necessary for designing any jig depends on the ability of the man employed. A first class man should be able to turn out an assembly drawing of this jig, with three views, in about 4 hr. Exceptional men might even complete a simple job like this in 2½ to 3 hr. For estimating purposes, however, 5 hr. should be allowed, which is sufficient to include all the preliminary work.

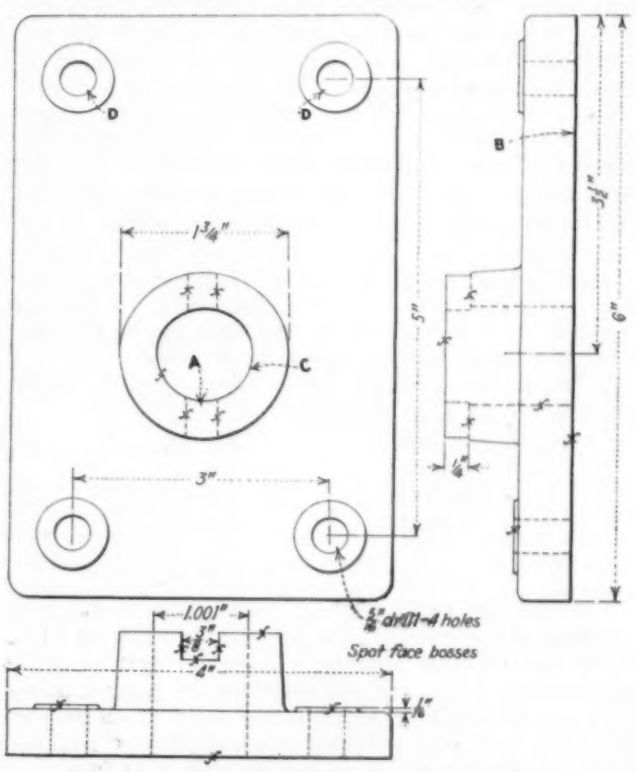


Fig. 81—Example of work requiring fixtures

The writer has endeavored for some years to derive a ratio between the time spent on design and that consumed in detailing. Records show in ordinary jig work, when the designer has preliminary designs to serve as a basis for his figures that the detailing takes approximately twice as long as the design. This ratio is not always dependable though, for in complicated work time is sometimes spent by the designer in "thinking" or in changing his ideas while designing, as he sees opportunity to improve the general construction or to simplify the manufacturing problem.

This is the twenty-third and final article. The twenty-second was concluded on page 545, Vol. 62.

As a result, the designing time is increased and the detailing may only take half again as much time as the design requires. Ordinarily the writer has found it safe to use the multiple 2 for detailing. It is a good idea to keep records of characteristic jobs and establish an average ratio suited to the class of men employed. After the work has been designed and detailed it must be checked for errors as follows:

From the drawing of the work, note location points and clamping methods and see whether the piece can actually be placed in the jig and removed without difficulty. Take nothing for granted. Make certain that details fit each other, that holes register, and that suitable allowances are made for various fits.

This work often involves mathematical calculations in order that the toolmaker may have dimensions and locations suitable for the work without requiring calculation in the shop. All this takes time, an allowance for which should be made in the estimate. Sometimes a simple jig can be checked in an hour while at other times several hours are required. Quite often an allowance of 20 per cent of the total designing and detailing time will be found sufficient unless the work is very complicated. For example, with design 4 hr. and detailing 8 hr., the checking allowance might be 2.4 hr. Ordinarily this ratio is safe and may even be reduced on simple work although it is seldom less than 10 per cent.

When the checker has completed his work the drawings are returned to the detailer for any necessary changes. These changes of course will depend upon the care that was used in making the drawings and the experience of the detailer. Changes sometimes do not require over ½ hr., while others take much longer. Carefully made details should not require over 10 per cent to 15 per cent of the detailing time for making changes. If it comes to more than this, on the average, a better class of detailers should be obtained.

With allowances mentioned the summary of the drawing time would be as follows:

Designing	5.0 hr.
Detailing	8.0 hr.
Checking	2.4 hr.
Changing	0.8 hr.
Total	16.2 hr.

Charges for designing jig work vary in different sections of the country, the prices ranging from $1 to $1.50 per hr. and sometimes even as high as $1.75. Occasionally designing and checking are quoted at one rate and detailing at another, but more often it is all done at a fixed rate. Ordinarily a quotation on jig work does not separate the items but is given in this form:

Designing, detailing and checking drawings ready for the shop—X hr. @ Y rate per hr. = total.

If different rates are quoted for designing and detailing, designing and checking—A hr. @ $\$B$ per hr. = E, detailing C hr. @ $\$D$ per hr. = F, $E + F$ = total.

It is quite common to make a quotation without specifying the number of estimated hours, giving the total in dollars and cents. Occasionally this work is done at a fixed hourly rate with a maximum figure:

Designing, detailing and checking drawings ready for the shops $30, work on an hourly basis at $1.50 per hr. If the cost on an hourly basis is less than the amount specified the customer will only be billed for the actual time consumed. If the cost is in excess of the amount specified the extra amount will be born by the bidder.

Quotations on drafting work usually specify terms of payment depending on conditions. Usually bills are rendered weekly with a limit of ten days for payment and allow a discount of 2 per cent. At other times the bills are net and payment is required within the time mentioned. The arrangement depends very largely upon the size of job, the reliability and rating of the customer and the financial condition of the contractor.

On large jobs, where a number of men are employed, terms are often desirable which do not require the contracting firm to finance the operations, at least for more than one week in advance. Sometimes a preliminary retainer is required equal in amount to approximately one week and bills are rendered weekly under an arrangement for immediate payment. Such matters as these are usually out of the hands of the estimator, although in some cases the quotations are sent out by him through the sales department.

Drawings for die work are estimated on the same principle as are those for jigs and fixtures except when complicated dies are required such as are used in drawing operations, or when several dies are used and, as a consequence, more than one drawing is needed. The estimator on this class of work must be a practical diemaker or understand the work thoroughly, for it is well known that experimenting is necessary and drawings cannot always be made complete. Thus in determining the shape of a blank for a rectangular steel box with narrow flanges, the designer must rely on the diemaker. The practice varies in different shops. Some make careful drawings, giving as many dimensions as possible and others making simpler drawings leaving details to the judgment of the diemaker.

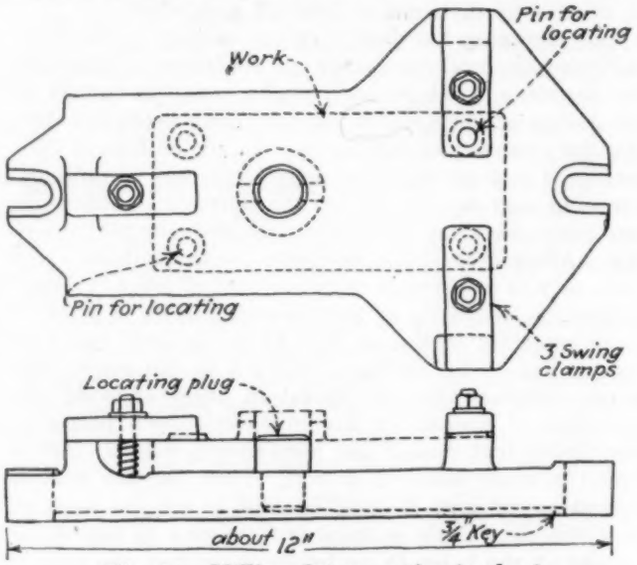


Fig. 82—Milling fixture estimate sheet

The matter of standardization of punch holders, bolsters, etc., also affects the drawing estimate. One large manufacturing concern has standardized these units and even has them printed full size on tracing paper so that only certain portions pertaining to a given piece of work need be filled in. The estimator, therefore, must be governed by the system used in his own factory.

In estimating the drafting time for gage work the same conditions are found. Many of the standard types of gages require nothing more than the filling in of two or three dimensions. Gages of a special nature, such as indicating gages or those which are used for inspection purposes, naturally require drawings, but

a good freehand sketch is a basis on which the estimate may be made.

Milling cutters, form-tools, boring bars, recessing tools, reamers, etc., often need drawings and turret tool equipment generally includes some special cutting tools. Drawings of these must be made. A side-milling cutter of special size or one with inserted teeth usually requires a drawing unless such tools are thoroughly standardized. Even then a drawing is often necessary in special cases and of course form-cutters must always be drawn. The practice varies, as some factories make cutter drawings very carefully while others used a diagram form, and the toolmaker makes the cutter in accordance with standard practice.

The estimator must be governed by local conditions but, when drawings are necessary a good draftsman can easily draw a 6-in. side-milling cutter and give sufficient information for the toolmaker in 1½ to 2 hr. An inserted-tooth cutter will require about the same length of time. It is, of course, not customary to show all of the teeth in the cutter. A form cutter may take from 4 to 6 hr., depending on the contour and the difficulty of putting on accurate dimensions.

Piloted boring bars such as those used in turret lathes can ordinarily be designed and detailed in from 2 to 3 hr. unless they contain a number of cutters or some elaborate method of adjustment which makes them highly special. Facing heads, recessing tools, special turning tools, or box tools vary greatly and some require several days to draw and detail. On all of this work the basis from which the estimator must work is a freehand sketch or a tool layout to approximate scale.

An idea is given in Fig. 83 of the type of sketch generally used for estimating turret tools. The sketches are often very crude and not more than two or three dimensions are given. The example *A* shows a plain piloted boring bar having a single cutter. Such a bar would not ordinarily require over 1½ to 2 hr. for designing and detailing while 2½ hr. should be sufficient for total designing, detailing and checking. A multiple-cutter bar of the same general type might require a little more time but it is seldom that any boring bar of this type would require more than 3 hr. for completion.

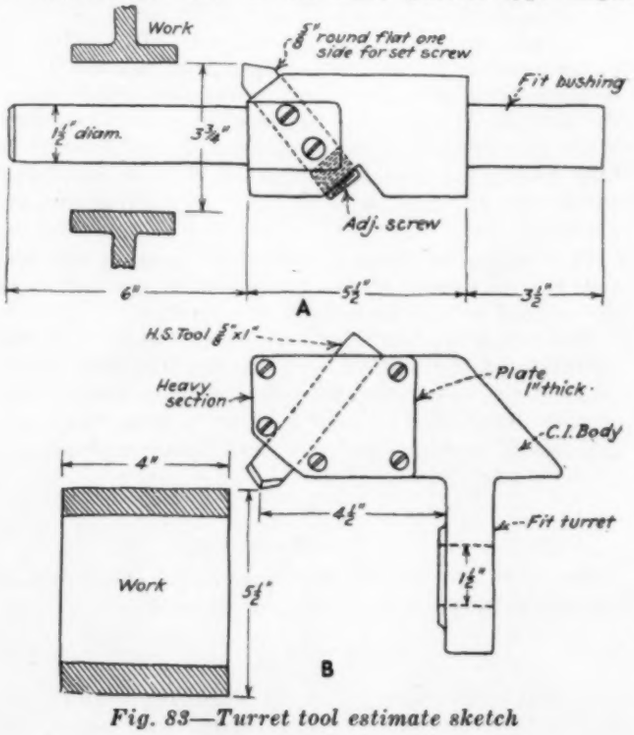


Fig. 83—Turret tool estimate sketch

The turning tool shown in example *B* has a cast-iron body, which is fastened to the turret, and a single tool, held in place by setscrews in a cover plate. The cast-iron body must be detailed as well as the plate and the tools. An assembly is also generally made, 4 to 5 hr. drawing time being generally sufficient. With multiple tools a little more time is necessary. These examples are sufficient to show the general requirement on this kind of work.

A more difficult problem which must be approached cautiously is presented in estimating drafting for special and automatic machinery. So much depends upon the type of machine to be designed that it is difficult to give information of value on this kind of estimating. Although the writer's experience on this work covers a period of some years, there were occasional cases when the estimate was not sufficient to cover the work. We all make mistakes and errors in judgment, when estimating, and it is a very easy matter to leave out some item which should have been included.

For this reason, the safest procedure is to spend some hours if necessary in making up a small sized drawing of the machine to approximate scale, giving two or three views, if they are required, to make the operation and general construction clear. From this drawing a very good idea can be obtained of the labor involved in the design but, if it appears likely that it will be somewhat complicated, it is best to make generous allowances. Changes in design are always likely to be required and things which look possible on a small-scale sketch take on a different appearance when worked to full size. For example, an automatic machine for which an approximate small-scale sketch has been made includes an indexing mechanism, magazine attachment, feeding device and other details that have not been thoroughly worked out. Six weeks or 264 hr. may be sufficient for the actual design, but the magazine attachment or the indexing mechanism may complicate the situation so that several separate assembly drawings must be made in order to develop the best possible arrangement. Thinking out some of these problems consumes a great deal of time. While this is not considered in the drawing estimate, an allowance must be made for it in order to avoid loss. It is advisable to add ⅓ or ½ of the designing time to cover the situation.

The detailing and checking and the necessary changes on automatic machinery almost invariably run from 2½ to 3 times the designing time. For the designing, a high rate is invariably charged, ranging from $2.50 to $5 per hr. The detailing and checking charges are at rates varying from $1.25 to $1.75 per hr. The summary for an estimate of this kind would appear as follows:

Designing and preliminary work,			
264 hr.	@	$3 =	$792
Extra allowance for design,			
90 hr.	@	3 =	270
Detailing and checking, 1,062 hr.	@	1.50 =	1,593
Total			$2,655

In quoting to the customer the hours would probably not be specified but would be given as follows:

Estimated cost to design	$1,062
Estimated cost to detail and check	1,593
Total	$2,655

Generally a note is appended to the quotation to the effect that work will be done on an hourly basis at a rate of $3 per hr. for designing and $1.50 per hr. for detailing and checking. Also various data may be given regarding terms of payment. For example, bills will be rendered weekly for payment within a specified time, three days or ten days, up to 75 per cent of the estimated price. The balance is due on completion of the drawings. It is mutually agreed that, although work is done on the hourly basis, it will not exceed the estimated price by more than 20 per cent and if it comes under the estimated price the customer will receive the benefit of the reduction.

A retainer check for 20 per cent of the estimated cost is frequently requested with the order. This matter of course is open to argument depending on conditions, but the writer believes it to be the proper course in the majority of cases, as it does not force the contractor to finance the proposition. Any arrangement can be made which is fair to both parties, but whatever it is, it should be carefully specified on the quotation in order to avoid future differences of opinion.

In estimating automatic or special machinery, considerable latitude is always advisable because there are so many chances for loss of time during the progress of the design. With a carefully made preliminary drawing, the chances for omissions are considerably lessened but in the actual progress of the design no man can say, absolutely, how many "snags" may be encountered or how much revision of the main design may be necessary.

Some firms, which specialize in the design and building of automatic machinery, refuse to quote flat prices on this work and do it only on a time and material basis. There are others who will design, build and install the machinery under an absolute guarantee that it will run properly and turn out a specified amount of work in a given time. Such firms charge a sufficient price to cover all sorts of contingencies to protect themselves from possible losses. If everything works out nicely under these conditions a large profit is made but if something is troublesome, or if the mechanical problems connected with the design require a great deal of extra work, or if the machine under test does not function properly, then the extra allowance is needed and the profit is cut down to a minimum.

Drills and Drill Speeds

By Chester H. Franklin

There is a little confusion in some quarters regarding the advantages in the use of high-speed steel for drills. Where the machine or work will stand high drilling speeds and feeds, there is no question as to the economy of using high-speed drills. But the fact that probably not over 20 to 25 per cent of the drills made are of high-speed steel, shows that there is still room for carbon-steel drills. In some sections, such as Detroit, large quantities of high-speed drills are used, but the average is about as given.

Carbon-steel drills are still run at about 30-ft. cutting speed in iron and steel, while for soft brass and aluminum there is hardly any limit. For hard brass, which sometimes means hard spots due to impurities, slower speeds must be used.

High-speed drills are run from 80 to 100 ft. per min. on almost any sort of steel except the harder alloys, such as chrome-nickel. Tests have been run at over 250 ft. per min. in cast iron; of 180 ft. in machinery steel; but in chrome-nickel, about 60 to 70 ft. per min. seems to be the practical limit. Even on chrome-nickel steel, however, the drills will stand feeds of from 0.001 to 0.02 in. per rev., which means from 1 to 2 lb. of metal removed per min. by drills of from 1 to 1¾ in. in diameter.

The only way to know the maximum drilling speed for any job, however, is to run the drill at a speed at which it shows signs of distress and then reduce the speed or feed, or both, say 10 per cent.

The Rust Resistance of Nickel Plating

The test used by the Bureau of Standards at Washington, D. C. for determining the rust-resisting properties of nickel coating has been adopted by the C. G. Spring and Bumper Co., and its use with certain modifications has proved to be an efficient means for maintaining quality of work. It is described in No. 12 of the company's series of articles on bumper engineering as follows: The sample to be tested is placed in a specially designed box into which is sprayed or atomized a 20 per cent solution of common salt. The presence of salt water accelerates the oxidation of the steel, and if there are any weak spots in the nickel coating, these will soon show up as spots of rust.

The government test specifications state that the test shall terminate "with the first appearance of rust." This is not necessarily a measure of the rust resistance of the sample, however, and it is better to continue the test until the rusting is visible to the observer stationed three or four feet away.

Many specimens will show slight rust spots after a very short exposure to the salt spray, after which no further rusting will be observed for days. On the other hand, some samples will remain perfect for a few days and then break down completely. Obviously the first sample is the better, but according to the government test it would be given a very low rating.

In order to fully evaluate the protective ability of nickel plating an arbirary rating was devised based on both the length of time the sample was subjected to the salt spray and its appearance at stated intervals. While this method is based on visual rather than absolute means for the determination of rust resistance within the average limits of error such variations are negligible.

This system has been in use by the company for over two years. Copies of the rating chart and details of the method will be furnished on request.

The salt spray test is an excellent indicator as to the condition of the plating solution, the thickness of the nickel coat, and the quality of the plate itself. The cost of installation of such a device is exceedingly low and would amply repay any manufacturer who uses nickeled parts to any extent.

Erratum

On page 459, Vol. 62, of the *American Machinist*, in the article by Allan H. Candee, the formula $p_n = \frac{p_b^2 + p_x^2}{\sqrt{p_b^2 + p_x^2}}$ should read $p_n = \frac{p_b \times p_x}{\sqrt{p_b^2 + p_x^2}}$ and on page 460 in the same article the words, right-hand half, in line fourteen, second column, should read, upper half.

Lubrication of Machine Tools

By Allen F. Brewer
Mechanical Engineer, The Texas Co.

Consideration of wearing parts of machine tools for correct lubrication—Lubrication of lathes, planers and other machines—Automatic and individual lubrication

IN MACHINE shop practice today, the life of a machine tool will depend upon the material from which it is made, the condition of the machine in which it is used, the character of the work which it performs and the extent to which frictional resistance is reduced by suitable lubrication of the cutting and wearing parts.

Intensive methods of production as developed during the war, brought out the fact that machine shop equipment certainly required quite as careful attention from a lubricating point of view as any other equipment in the plant. Especially was this true in the case of high-speed apparatus, such as the modern grinder, and drilling machine where speeds of several thousand r.p.m. might be necessary. The combined lubrication and cooling of cutting tools such as drills, etc., had long been known to be important; in fact, where high-speed tool steels are involved, it has been *estimated that cutting speeds could be increased perhaps 30 to 35 per cent by careful attention to the matter of tool lubrication. Yet the essential wearing parts of the machines were frequently so far overlooked and under-lubricated as to materially reduce the potential benefits that effective tool lubrication might involve.

Today, however, the modern machine tool engineer views his equipment in a different light. Very forcibly does he appreciate that where accurate work is required in conjunction with maximum production, it is most essential to carefully lubricate every wearing part not only of the machines themselves, but also of all the mechanical equipment connected with them.

Wearing Parts of Lathes and Their Lubrication

The essential wearing parts of the average lathe may be said to involve bearings, slides, cams and gears. The carriage is usually retained in position on the lathe bed by means of V-shaped projections which travel in corresponding grooves in the bed. V-lubrication is important due to the fact that abnormal wear therein will contribute to operating difficulties and the possibility of mis-alignment occurring. One method of lubricating these is to attach felt wipers in the sliding element or on the end of the carriage. These are soaked with oil at periodic intervals. These wipers furthermore aid in keeping the bed Vs clear of dirt. Other designs provide for automatic stream lubrication. Still others make use of revolving wheels located in the bedplate, which are so installed as to come in contact with the moving element as it slides over them. These wheels are usually located in a depression which can be partially filled with oil. Thus as they revolve, they carry a film of oil to the moving slide.

While the spindle is regarded by certain authorities as perhaps the most important constructional part of the lathe, the gears which make possible the attainment of the necessary speeds are probably the most important power members.

Splash Feed Lubrication

The essence of proper gear operation is their lubrication. This has been fully realized by the progressive machine builders and as a result speed change gears at least are usually equipped for bath or splash feed lubrication. An added advantage is derived on account of the fact that usually the one lubricant can be made to serve both the gears and their shaft bearings. In most lathes the gears are comparatively small and so carefully designed, cut and aligned that unless excessive bearing wear takes place, lubrication can be effected by means of a relatively fluid lubricant, which will have sufficient viscosity to prevent metallic contact between the gear teeth and still be light enough to penetrate effectively to all the bearings. For this purpose the machine oil usually adaptable to bearing and slide lubrication should be suitable. Usually a viscosity of from 200 to 400 sec. Saybolt at 100 deg. F. will suffice.

Certain classes of heavier bath lubricated gears on vertical or larger types of horizontal turret lathes may require a heavier bodied oil. Especially would this be true where the gears are enclosed, but have their bearings so located without the gear case as to permit of independent lubrication. In such installations, a viscosity of from 120 to 200 sec. Saybolt at 210 deg. F. would be advisable, depending on the closeness of mesh and whether back-lash was prone to occur. It must be remembered, however, that while a heavier lubricant will eliminate a certain amount of the noise of operation and the pounding and hammering due to back-lash, especially when speeds are changed, the use of too viscous a product might readily involve serious power losses on account of the added friction developed by the gears moving through the more or less inert bath of lubricant.

But all lathe gears are not so enclosed as to permit of bath lubrication. Some gears must therefore be lubricated by direct application of the lubricant to the teeth. On such service, the lubricant must not only be sufficiently viscous as to preclude the occurrence of metallic contact between the teeth, but also it must be so adhesive as to stick tenaciously to these latter and resist the action of centrifugal force. Certain types

Abstracted from article appearing in *Lubrication*, March, 1925.
*Battle—Industrial Oil Engineering, p. 635.

of greases meet the lubricating requirements admirably but their adhesive characteristics are so low as to render them readily subject to throwing off. Straight mineral gear lubricants, however, overcome this difficulty and meet both requirements admirably. Hence they are generally preferred for all such exposed gearing. In viscosity they might often have to range as high as 1,000 sec. Saybolt at 210 deg. F., according to the speeds and temperature of operation and the tooth pressures involved.

Lubrication of Planers

In reality the matter of gear lubrication is practically the salient feature of efficient planer operation. Mention has been made about the occurrence of rolling and sliding friction between the respective teeth as they pass into and out of mesh. Theoretically, this would occur whether the gears were run dry or not. Actually, however, the continued occurrence of solid friction would tend to supplant rolling friction with sliding friction. Wear would thereby tend to increase proportionally. But the substitution of fluid friction for solid friction which is brought about by the use of a suitable lubricant which will permit of the formation and maintenance of the proper film over the gear teeth, will enable rolling contact to occur as originally designed for, unless of course, the gears work out of line or other faulty operation occurs.

Bath lubrication alone or the mere rotating of the gears suitably immersed in the lubricant will usually permit of the use of a grade of gear lubricant akin to a steam cylinder oil in viscosity. In certain cases this will be a decided advantage, for with a properly enclosed gear case, we could rely on perfect lubrication occurring for a considerable length of time without the necessity for attention or renewal; just as would be possible with the transmission gearing of our automobile. But this would require the stocking of a special grade of gear lubricant.

To get around this, certain builders have designed their machines so as to permit of the use of force feed lubrication. Thus gearing, bearings, slides and guides may all be served by the one lubricant under suitable pressure to insure its penetration to all wearing parts. In such systems a straight mineral engine or machine oil of from 200 to 400 sec. Saybolt at 100 deg. F. would be generally applicable.

The essential sliding mechanisms involved in the average planer include the table Vs or guiding grooves such as are described for the lathe. Planer Vs are subject to considerably higher pressures and more wear than are these same parts on a lathe. For this reason they are generally lubricated by force feed or by means of automatic oil rollers of some form. Where force feed lubrication is employed it is usually customary to serve not only the Vs but also the guides, and bearings and gears of the rail and other mechanisms. For the purpose of general machine lubrication of this nature an oil of 200 to 400 sec. viscosity as recommended for the lathe would be suitable. Gear lubrication wherever it must be carried out independently of the Vs and bearings, will be contingent upon the type of gears and their mode of operation, just as explained for the lathe. Therefore, lubricants as specified or used for these latter will be equally satisfactory if applied to the planer gears.

One of the most interesting features which has accompanied the development of the modern milling machine has been the trend towards automatic lubrication, that is lubrication so carried out that a continuous feed of oil is directed to all these wearing parts under sufficient pressure to preserve a suitable fluid film between them and prevent metal-to-metal friction. In such a system the one grade of oil, i.e., a medium viscosity straight mineral machine oil would usually give satisfactory lubrication of all the wearing parts involved.

Splash and bath lubrication of gears and frequently many of the other bearings, is also used on certain types of milling machines. Such systems are particularly adaptable to column mechanisms, for with the gears of the drive shafts running submerged in oil, a sufficient amount of this latter is splashed to all parts of the column to effectively lubricate the bearings. Here, however, the lubricant does its work under relatively low pressure, volume being relied upon to maintain the requisite oil films. Therefore, whereas a machine oil of perhaps 200 to 400 sec. Saybolt at 100 deg. F., might suffice in a pressure oiling system, a heavier product even approximating a low viscosity mineral cylinder oil might be necessary for splash or bath lubrication.

Lubrication of Boring Mills

Boring mills involve much the same type of wearing parts as the lathe, or planer, etc. Experience has proven that in general all parts of a boring mill will function most satisfactorily if provision is made for forced lubrication. For the general lubrication of boring mills a medium bodied straight mineral oil has been found to be most satisfactory. Essentially it must be of the same characteristics as the oil used elsewhere in the shop. For all-round lubrication a viscosity of from 200 to 400 sec. Saybolt at 100 deg. F. will be usually found to be suitable. Such an oil will have sufficient body to not only serve the bearings, but also the slides and gears where it is delivered under sufficient pressure. In cases where gears are not enclosed in oil-tight casings, or, on rack, worm or screw mechanisms a somewhat heavier product might be advisable. Frequently a viscosity of approximately 1,000 sec. Saybolt at 210 deg. F. would be necessary for such service. For other gearing which operates enclosed and designed for splash lubrication a straight mineral oil of a viscosity akin to a light steam cylinder oil would probably serve the purpose best.

Lubrication of Drilling Machines

Drilling machines are usually subjected to high production requirements. They operate at relatively high speeds and in proportion to the size, their wearing parts are subjected to high pressures. Centralized automatic lubrication has been developed to a marked extent in this connection, and is today claimed to solve the lubrication problems so inherent to vertical bearings and high speeds. It is making possible the use of but one grade of oil, thereby reducing expense and the possibility of difficulty due to application of the wrong product at any time.

In connection with gearing, however, as with boring mills and other tools, there are, of course, some cases where these mechanisms will be designed for individual or separate lubrication. Naturally bath or splash oiling is preferable, and in such instances the same products heretofore specified under boring mills would be suitable. Exposed gearing or other toothed mech-

anisms running perhaps in non-oil-tight casings, on the other hand will require a heavier product which will maintain an effective lubricating film on the teeth notwithstanding any action of centrifugal force which may be prevalent.

Other Machine Shop Equipment

Just because such machines as the grinder, screw and thread cutter, hobbing machine, chucking machine, etc., are to an extent more limited in application than the more massive tools already discussed, is no reason for classifying them as auxiliaries, even though they may amount to this in many shops. In general their lubrication will differ but little from that already discussed. On such machinery, however, the use of independent oil and grease cups will often be the most economical and satisfactory procedure.

As a result the same varieties of lubricants as recommended elsewhere in this article will in general be applicable to similar wearing parts on these so-called auxiliaries. For instance on exposed gearing a relatively high viscosity straight mineral gear lubricant would probably be desirable whether we were dealing with a pipe threading and cutting machine or gear hobber, etc. Likewise, both splash or force feed lubricating systems would function very well if a 200 to 400 viscosity machine oil were used. For grease cups, in turn, dependent on whether they are of the compression or pin type, a grade of grease should be used which, under the operating temperatures involved, would liquify to just the right degree to afford proper lubrication.

Conclusion

It will be noted that the matter of automatic lubrication has been stressed wherever possible and every opportunity taken to further an insight into the working details of the more accepted lubricating systems in use today in the machine tool industry. Primarily this has been influenced by a natural preference on the part of the lubricating engineer for automatic lubrication due to the extent to which it promotes efficient operation, saving in lubricants, and increased production.

In the application of individual lubrication, however, due consideration must always be made for the lubricating requirements of the parts involved, the labor conditions and the safety of the operators. On intricate massive machinery where lubricating requirements are frequently severe, splash, force feed or bath lubrication would in general be probably the most satisfactory. On the other hand, the numerous smaller external wearing parts so necessary to every type of machine tool can be more economically lubricated by hand via suitable oilers, or with grease cups.

A German Steam Engine Without Boiler

Much interest is being displayed by power engineers in the reported invention in Germany of a new type of steam engine which is described as being practically boilerless, compact and capable of raising steam in a few minutes.

The following article on the subject is translated from the Magdeburgische *Zeitung* of Feb. 5, 1925:

"Bernhard Becker, of Hohra, near Weimer, Germany, has just invented a practically boilerless steam engine. To be more accurate, he has invented a device for generating steam without the use of the customary bulky and slow-heating boiler. His invention is said to be an absolutely new departure in heating technique. It consists of a pipe system about one two-hundredth the size of that in a normal boiler. Only a small flue is required and no special boiler house, yet it is capable of generating as much power as an ordinary boiler, two hundred times its size. While the average steam boiler of larger size requires about five hours to generate from six to eight atmospheres (90 to 120 lb.) pressure, Mr. Becker's device develops 15 atmospheres (225 lb.) pressure in five minutes.

"The novelty of the device is found in its diminutive size and efficiency. The term 'boiler,' as applied, is a misnomer, for the reason that the water used never boils; it never has a chance, being forced into the pipes in an atomized state and instantly converted to steam. The original model is heated with oil, yet any fuel may be adapted. Feeding the 'boiler' and setting to a particular pressure are done automatically, providing a great saving in fuel. Generators of this type are being constructed for generating 150 atmospheres (2,250 lb.) pressure. Its future can only be imagined.

"A company has already been organized to exploit the invention, and generators are to be manufactured at Hohra, soon. It is expected to have a revolutionary effect upon the construction of automobiles, tractors and farm engines of various types."

What Is a 50-Ton Press?—Discussion

By Charles Moran

Some time ago I was confronted with the same problem of press selection as appeared on page 376, Vol. 62, of the *American Machinist*, and appealed to the press makers to furnish me with data on which to base my calculations. I received the following from them:

For forming or bending there are no reliable data.

For blanking operations, without considering shear on the tools, the safe ram pressure in single and double-crank presses equals the product of the square of the shaft diameter at the main bearings, and the constant specified by the maker for the various types of press. The constants given me were 3.5 for straight-sided geared presses, 3 for the similar frame but flywheel style, and 2.5 for the similar frame with flywheel but extra wide; 2.5 for gap-side geared presses and 2 for this frame with the flywheel.

Certain conditions were imposed on the use of these constants to render them applicable.

Pressures are to be exerted near the bottom of the stroke.

Flywheel presses are to be limited in speed from a minimum of 50 to a maximum of 125 strokes per min., depending on size. Geared presses are likewise to be kept within a 5- to 60-stroke per min. range.

Extra wide presses are not to be used on work that will concentrate the load at the center of the bed.

The safe ram pressure of any press having one or more cranks supported between two bearings, such as toggle drawing presses and forming presses, may be determined by these cutting-press rules.

The approximate tonnage required to blank (without shear) is the product of the length of all simultaneous cutting edges in inches, by the thickness in inches and by a constant, 30, for steel, with 20 for soft brass and copper.

The Effect on American Industries of American Loans to Germany

By O. B. Iles

President of the National Machine Tool Builders' Association

THE announcement recently of a ten million dollar loan to the German-Krupp organization by United States bankers and almost immediately following this, announcement that the Krupps had taken over a big Spanish organization, including plants, mines, etc., and thereby had transferred large orders for machinery and equipment to German industries, has created considerable discussion among the executives of the United States industries relative to the action of our bankers in making such loans, and has called attention to the destructive results to machinery and equipment manufacture in the United States.

Until in the recent past, the United States has been a borrowing nation. During its period of construction and expansion, it was necessary to seek financial aid in the money centers of Europe. The United States was developing, expanding and filling out. As time goes on we will come nearer and nearer the saturation point in the demand for machinery and equipment for home expansion purposes. It will be necessary for us to seek new outlets for our machinery and equipment; it will be necessary for us to change our attitude from that of a borrowing nation to that of a loaning nation.

During the year 1924, commerce reports state that the bankers of the United States loaned to foreign nations and industrials the sum of $1,208,438.394 and that $314,805,000 of this was used for refunding purposes, leaving a balance of nominal new capital loans of $893,633,394. These amounts were loaned to governments for refunding and taking up deficits and to industrials for refinancing and expansions.

In addition to the above amounts, there are reports, believed reliable, that about $300,000,000 additional was loaned to industrials by United States bankers not reported.

Colonies for Customers

England, Germany, Belgium, France, Holland and other nations, that in the past have grown to be largely industrial, have had colonies upon which they depended for an outlet for the products of their manufacturing institutions. They have jealously guarded the interests of these manufacturing institutions within their borders.

Due to their form of government, the commercial and business interests of these other nations were able to enlist the active co-operation of all of the diplomatic representatives and commercial attachés, not only in the colonies, but also in all other countries. They have been able in the past and are now getting the co-operation of their bankers in addition to all diplomatic representatives in the interest of their industries and manufacturers and their welfare. When a railroad is built in China or Chile or India and English capital or German capital is used to finance this railroad, there is a clause in their agreement, making it necessary to spend the money for the material, machinery and equipment in England or Germany according to the source of the financial assistance. With the very close co-operation of the diplomats and attachés, these orders for machinery and equipment do come to the manufacturers of the country furnishing the finances.

Due to the natural mechanical and designing ability of the machine tool engineers of the United States, backed up by the demand of manufacturers of metal products in the United States for rapid production machinery, the machine tool industries of the United States have developed rapidly in the last thirty years and are able to offer machine tools to the world that have no equal. They are willing to take the chance of presenting these facts to the prospective users of machine tools any place in the world and to show them that the productive and therefore monetary returns from their investment in machine tools made in the United States will be as valuable or more valuable than an investment in a machine tool made in any other country regardless of the initial price paid and regardless of the exchange rates and transportation costs to the various countries of the world.

Difficult Competition

But what does it avail a machine tool builder to be able to offer such inducements in China or in South America or South Africa, if when he approaches the prospective customer he is told "this institution is financed by a German, English, French, Belgium or Dutch financial institution and we are under written obligation to send all the business along the machine tool line to these countries."

What does it matter if there is a theoretical economic law, if in practice it is interfered with, obstructed and completely overthrown by competing nations? What does it matter if the doctrine of *laissez faire* is theoretically economically sound, if all do not play the game according to the same rules? What does it matter if there are those economists who believe in what is called the "Triangular settlement of international transactions?" That is, if United States bankers furnish Argentina with a large loan for industrial development, without any suggestions as to where they shall buy their machinery or equipment, and Argentina places the order with Germany for their machinery and equipment and then pays for it in wheat and Germany pays us in potash.

We believe that there is more value to the United States people by the export of $1,000,000 worth of machinery or equipment than there is in the exporting of $1,000,000 worth of wheat or coal or raw material, for the reason that in the export of the raw material or the wheat, there is only the cost of its production. In the export of the machinery there is the cost of production of the raw material plus the refinement, the skill, the engineering ability and the labor necessary to manufacture this machinery or equipment.

Extract from a paper presented before the annual meeting of the Bankers' Association for Foreign Trade, held at Cincinnati, April 2.

Double-Head Welder on Car Wheel Work

By A. C. Colby
Superintendent of Equipment, Department of Street Railways, Detroit

Time of welding wheels reduced almost half by addition of second head on automatic welder—Special grinder increases mileage by reducing amount of metal removed

ROLLED steel wheels used by the Department of Street Railways in Detroit are welded and ground when the flanges become worn, with a view toward obtaining maximum wearing life. This is accomplished by reducing to a minimum the amount of metal that must be removed from the treads of the wheels to true up their contours after they have become worn in service.

The practice of welding flanges, either with automatic or hand equipment, has been adopted by many properties. Results with automatic equipment have been reported uniformly satisfactory, but some difficulty has been experienced with hand welding. When only a comparatively small number of wheels are to be welded, however, some properties are using the hand method.

One feature of the Detroit practice is the use of a double-head welding machine to speed up the rate of welding. This lays two beads of metal on the wheel flange simultaneously instead of one bead per revolution, as in the case of a single-head machine. It was found to be a comparatively simple matter to add the second welding head to a single-head machine, thereby almost doubling its capacity. The cost of welding any particular wheel depends of course on its condition, but for a given wheel, the double-head machine reduces by almost half the time formerly taken with the single welding head.

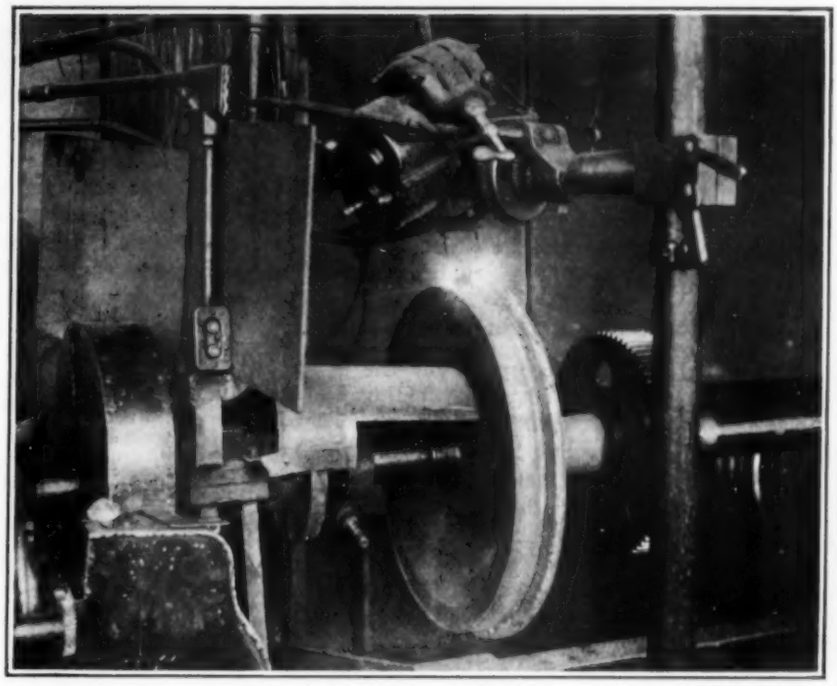


Fig. 1—The automatic welder with addition of second head

After welding, the contour of the wheel is trued up by grinding the tread and flange instead of turning. This results in the removal of a minimum amount of material from the wheel. Consequently, a considerable saving in the amount of metal removed from the wheel is made as compared with the customary practice of turning the wheels either with or without flange welding. To make grinding a success, however, the wheels must be attended to before they become worn beyond a certain stage. If one of the flanges is permitted to wear excessively thick, grinding is no longer satisfactory or economical, and it is better to turn the wheels to restore their contour.

The A. E. R. E. A. standard limit-of-wear gage is used by the Department of Street Railways for determining when wheels should be taken out for attention. If they are removed promptly after reaching the limit shown by this gage, the flange and tread are usually found to be in condition which permits them to be repaired by welding and grinding.

The welding machine in operation is shown in Fig. 1. This is the standard type of General Electric Company automatic equipment, and the arrangement of the two welding heads is clearly shown. No difficulty has been experienced in feeding the welding rod from each head so that the material is deposited evenly on the wheel.

The machine used for grinding is shown in Fig. 2. This was built by the Norton Company, Worcester, Mass. The grinding wheels are shaped so as to finish the flange and tread simultaneously, shown in Fig. 3. When these wheels become worn, they are returned to the manufacturer for redressing. After the throat and flange are finished, there is a sharp corner left at the back of the flange which must be ground off. Some saving in time has been made by cutting this corner off with an acetylene torch, and then finishing with the grinder.

Reprinted from *Electric Railway Journal*, issue of March 21.

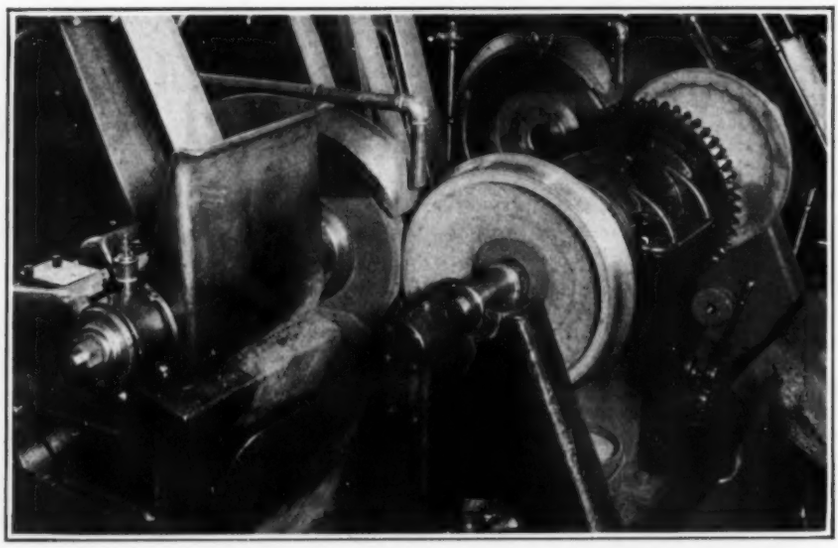


Fig. 2—The specially built grinder for truing up wheels after welding

Subsequent to the installation of the grinder by the Department of Street Railways, a similar machine was installed in the River Rouge plant of the Ford Motor Company and is used for grinding locomotive wheel tires.

Costs of Welding and Grinding

Comparative figures compiled for the month of October, 1924, show the costs of welding and grinding wheels. During that month a total of 485 labor hours were required for welding 250 wheels, of which approximately half had a nominal diameter of 34 in., and the other half 26 in. On both welding and grinding work, one man handles the machine. The rate of pay is 80 cents per hour. In the case of welding, the average time per pair of wheels was 1.94 hours, which makes the labor cost without overhead $1.55. This is an average figure for both the 34-in. and 26-in. diameter wheels.

There were 200 pairs of wheels ground during this month in 246 labor hours, or at the rate of 1.23 hours per pair of wheels. The labor cost for grinding was consequently 98 cents per pair. In addition to labor, there must be added the cost of welding material and power. These costs have been established as follows:

Cost of Welding Wire

34-in. wheel	$0.51
26-in. wheel	.39
Average	$0.45

Cost of Electric Energy

34-in. wheel, 23.1 kw.-hr. at 2.7 cents	$0.62
26-in. wheel, 16.5 kw.-hr. at 2.7 cents	.45
Average	$0.54

The total average costs without overhead are therefore as follows:

Welding labor	$1.55
Grinding labor	.98
Welding wire	.45
Energy	.54
Total	$3.52

This shows little saving, if any, over the cost of turning, using a modern type of lathe, with proper handling facilities and only one man. But it is in the increased life of the wheel that the greatest advantage comes from welding and grinding. The practice followed in Detroit has not been in effect long enough to permit the accumulation of comparative mileage figures, but an estimate can be made of the results to be expected. In addition, while the time of the welding operator is charged entirely against the wheel work in the figures above, he is available for miscellaneous welding jobs during the period that the automatic machine is in operation.

The standard flange in Detroit is 1 in. thick and $\frac{3}{4}$ in. high. On the basis of the A. E. R. E. A. standard limit-of-wear gage for this flange, it is necessary to remove approximately $\frac{7}{16}$ in. thickness of metal from the tread to restore the flange to its normal contour by turning, after it has reached the point indicated by the gage. Assuming that this occurs twice during the life of the wheel before it is scrapped, the wheels would have three periods of wear from the time they are first put into service until completely worn out. Starting with a tread thickness of $2\frac{1}{2}$ in. when new, and assuming that the wheels would be scrapped when the thickness is reduced to $\frac{1}{2}$ in., this would leave about 2 in. of effective metal in the tread. But of this amount, two turnings, each $\frac{7}{16}$ in. thick, are removed during the life of the wheel, to true up the contour of the tread and flange. Consequently, a total of $\frac{7}{8}$ in. of this metal finds its way into the shop scrap pile, and only about $1\frac{1}{8}$ in. of metal is actually worn off in service.

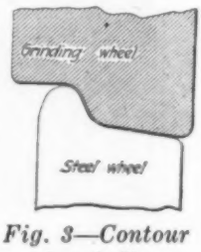


Fig. 3—Contour of grinding wheel

Assuming an average wheel life of 100,000 miles, this is obtained from the $1\frac{1}{8}$ in. of metal left to be actually worn off in service. This gives a mileage of slightly more than 11,000 for each $\frac{1}{8}$ in. of wear. If flanges are welded and ground, very little metal is taken off the tread to true up the wheel. Consequently a large part of the $\frac{7}{8}$ in. of metal which was formerly turned off is available for actual wear in service, and the wheel mileage may be reasonably expected to be increased in the same proportions as for the average mileage obtained. With 11,000 miles obtained for each $\frac{1}{8}$ in. of wear this would increase the mileage by 77,000 and would therefore add more than 75 per cent to the wheel life.

Mileage Is Increased

In addition to the saving made in the amount of metal taken off to true up the wheel, the practice of welding and grinding increases the mileage in another way. It is well known that when a wheel is turned the cut must be taken deep enough to remove the hard surface which has been rolled on the tread by contact with the rail. The practice of welding and grinding does not require the removal of this hard material and the life of the wheel is therefore increased beyond the amount that is indicated by the actual thickness of metal saved.

Factory Fire Protection

By H. Edsil Barr

Fire prevention and fire insurance—Supplementing the sprinkler system—Various types of chemical fire extinguishers — The importance of teaching their proper use and maintenance

THE total fire loss of property in the United States is about $500,000,000 annually. An average of 15,000 lives are lost and about 17,000 persons seriously injured from the same cause per year.

This economic loss of material and life, which is a direct tax on every inhabitant, through increased costs of living, has grown to such a staggering total that it can hardly be grasped. Fortunately the publicity being given the subject by the insurance companies is awakening the public to individual and combined responsibilities and much has been accomplished already. In this connection, the manufacturing plant, as a rule, includes greater chances for fire than other properties and proper means of protection should be known to every plant operator.

The old standby protection has been fire insurance which, regardless of protection methods, is always essential as a bulwark of compensation. Insurance, however, is not prevention, it is compensation after the loss and, in case of a bad fire, this compensation is liable to be only partial as compared with the actual material loss. It pays nothing for loss of business, loss of customers, or disruption of organization.

Many a business, well insured, has had a serious fire which has been fully compensated as to the material loss, but has been pushed to the wall or retarded years in its commercial position because of being put out of operation for a few months.

Good Will Can Be Lost Permanently

Much of the business of any established and successful concern comes from the good will and continued patronage of satisfied customers. Let them once be forced to buy elsewhere, and they are liable to find the same efforts to satisfy their requirements and may even be better pleased than with the previous connection. As a consequence, trade, once lost through inability to operate, can only be recovered with difficulty.

The prime requirement in preventing fire in the plant is continued watchfulness and care. Progressive factories have delegated to certain men the duty of constant observation and correction of conditions which might lead to fire. Every plant should have at least one such man. Every workman should be kept face to face with the importance to himself, as well as to the company, of being careful and of reporting promptly any hazardous condition which he may observe.

After every precaution has been observed it is essential that reliable and effective means be provided by which any fire that does get started may be squelched immediately. Dependence on the nearness of a local fire house is not sufficient, because the first three minutes taken to arrive are usually the vital ones.

Not the least of the values of adequate protection within the plant itself, is the reduction in insurance rate frequently possible. The automatic sprinkler system, where applicable, provides the broadest protection and effects the greatest saving in rate.

It should be kept in mind, however, that the sprinkler does not cover all requirements and most concerns having the system also have chemical fire extinguishers distributed around the buildings. The sprinkler system should never be allowed to go into action unless necessary. The fire should be put out by other means, if possible, because of the large damage which might be done by the deluge of water. The sprinkler system is of particular value as a protection at night, over weekends, holidays, and when the plant is vacant except for the watchman.

The Chemical Extinguisher

About 85 per cent of city fires extinguished by fire departments are put out with chemicals. They can be applied in a fraction of the time required for laying hose lines, are extremely effective and do a minimum of damage. The chemical fire extinguisher, then, should be provided in liberal numbers in every plant, regardless of a sprinkler system.

There are several basic types depending on the kind of chemical they contain and the class of fires for which they are the most effective. The proper application of these types is not widely known among plant owners, and is worthy of discussion.

The most familiar extinguisher is the 2½-gal, soda-acid type, which consists of a copper tank about 7 in. in diameter and 20-in. high, with a short piece of discharge hose. The charge consists of 2½ gal. of water in which 1½ lb. of bicarbonate of soda (baking soda) has been dissolved. An 8-oz. bottle, containing 4 oz. of commercial sulphuric acid is hung in a metal cage in the top of the extinguisher. The bottle has a loose stopper, generally of lead.

When this extinguisher is to be used it is turned bottom side up. The stopper then falls out of the acid bottle and allows the acid to flow into the soda water. A powerful chemical reaction results which expels the charge to a distance of 50 ft. or more. The wetting and cooling action together with the carbonic-acid gas which is generated is very effective. It is considered as being equal in effect to about forty times the same quantity of water. The chemical truck used by city fire departments contains the same chemical, generally in one or two 40-gal. tanks. They are put into action by turning a handwheel to empty the acid container.

The soda-acid extinguisher has the following limitations: It should not be kept in unheated buildings in

cold weather as the liquid may freeze. It should not be discharged on electrical apparatus as the water and acid will damage the apparatus. It should not be depended upon in case of oil, gasoline, paint and similar fires as the water solution tends to float the fire and spread it.

It is the most powerful type in use, aside from the above applications, and for general protection.

A "foam-type" extinguisher has been placed on the market in recent years. It has the same exterior appearance as the soda-acid extinguisher, but contains a solution which forms a large quantity of foam, suds, or bubbles, that makes a blanket over the fire and extinguishes it by excluding the air. This type will also freeze.

Extinguishers for Inflammable Liquids

The foam type is especially advised where there are open tanks containing inflammable liquids. When such liquids take fire they burn on the surface and are continually fed from below. Such a fire can be successfully put out only by smothering it. If the tank is very small, sand may be used to extinguish the blaze but, with a material which has not simply "flashed," it will immediately break into flame again.

Aside from an iron cover, which can be dropped, a foam extinguisher of the automatic type is advised. It is hung over the tank and is discharged when a lead fuse melts.

Both the soda-acid and the foam-type extinguishers must be recharged once a year to compensate for gradual weakening of the charge.

For protection of unheated buildings of all kinds, the 5-gal. calcium-chloride extinguisher is correct, in addition to the dry-pipe system of sprinklers.

This type contains a charge of water in which a considerable quantity of pulverized calcium chloride has been dissolved. No chemical reaction results in the operation of this extinguisher so it is provided with a hand-pump. It will throw a 50-ft. stream, requires no recharging until used, and will not freeze above 40 deg. below zero.

The Use of Carbon-Tetrachloride

There is a fourth standard type of chemical extinguisher that has been extensively adopted in recent years. A cylinder contains a quantity of carbon-tetrachloride, a clear, liquid chemical of interesting characteristics. It does not deteriorate and in the better machine is protected against evaporation. A hand-pump assembled in the cylinder is worked rapidly to expel the liquid. Its effect is to form large quantities of carbon dioxide. The liquid does not freeze at 50 degrees below zero. It is not damaging to furnishings or fabrics and, being a non-conductor, can be thrown on electrical apparatus without injury. As a result it is extensively used around electrical apparatus.

The type is also very effective on gasoline, paint, oil and varnish fires, where such material is on the floor, as it will mix with the burning material instead of spreading it.

Which ever of these types is adopted, in addition to the sprinkler service, the fact must not be lost sight of that constant attention must be paid to its condition and location, and to the training of the men to use it to the best advantage. If there is no sprinkler service, it is even more important, for an extinguisher that has been allowed to deteriorate and weaken, or to clog; or one that has been used, and not refilled, is a very useless and very sad object when the next fire is just getting a good start.

Systematic Use of Engineering Publications

By Geo. W. Childs

The statement, "We need to have some reading course mapped out for the foreman and men," was made in a discussion of an article concerning foremen which appeared on page 316, Vol. 62, of the *American Machinist*.

When I was connected with the Navy's engineering department at Washington, D. C., one of my duties was to read the principal American engineering publications, and several from other countries. I then indexed and filed references on many subjects that, in my opinion, would be of future service to my department.

Later I was engaged in a large steel foundry as works engineer. This company also subscribed to the engineering journals, and when I noticed that they were seldom read I thought of my previous experience and had the magazines sent to my office first.

I pasted a slip on each giving the names of the department heads and after reading the texts I marked in a column provided the articles that might be of special interest to each man's attention. The mail boy kept the magazines in circulation by following the sequence on the slip, and finally returned them to my files. The plan was productive of good results as each man went directly to the part marked for his attention with more than a general interest. I also card indexed and filed data from these publications which were applicable to the plant in general and other department heads frequently referred to this file for assistance on work they had in hand.

It is my opinion that engineers in general would find this scheme a practical one and find its practice a pleasure for they can thus be of real service to their associates. I know, also, that while my time was well occupied on my regular duties I was able to keep the plan in action without interference.

Fitting Spindle Bearings on the Heim Centerless Grinder—Discussion

By John J. Curley

In the article under the title given above, published on page 245, Vol. 62, of the *American Machinist*, mention is made of the use of a ground test-bar to which the spindle bearings are fitted, rather than to the spindle itself, but it is not stated that the size of the test-bar is a matter of great importance.

Some years ago the company by which I was then employed, made a series of experiments along this line in which test-bars varying in diameter by half-thousandths, from 0.002 to 0.007 in. oversize, were used with surprisingly varied results. Various grades and brands of oil were also tried.

The results obtained would seem to indicate that a certain thickness of oil film is best adapted to meet each different condition. The requirements can easily be discovered by this method and provision made to meet them.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

An Adapter to Hold Pistons for Turning

BY J. C. HARPER
Castle Douglas, Scotland

The adapter shown in Fig. 1 was designed in the first instance in order that a solid-spindle lathe might be utilized for the finish-turning operation on pistons.

Part *A* is the body of the adapter; threaded to fit the spindle-nose of the lathe, bored axially to fit the

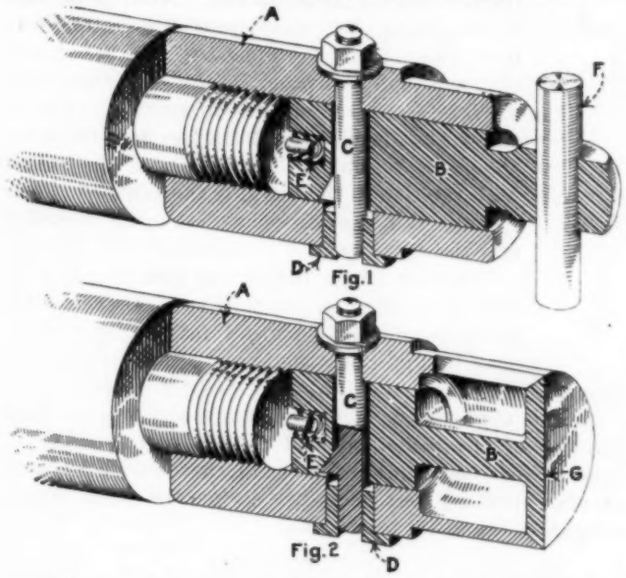


Fig. 1—Adapter to hold pistons for turning
Fig. 2—The same principle applied to an expanding arbor

draw-bolt *B*, and having two diametrically opposite holes drilled in the shell at right angles to the axis to serve as bearings for the cotterbolt *B*. One of these holes is drilled large enough to allow the cotterbolt, with its projection, to pass through, and afterward the bushing *D* is fitted in place.

The drawbolt *B* is drilled diametrically large enough to allow for its required travel axially when tightening up, and has an inclined recess running into this hole to suit the projecting part of the cotter-bolt. It is also drilled axially at the left end to form a recess for the spring *E*, the function of which is to insure the quick release of the drawbolt when the cotterbolt is slacked off. Part *F* is a pin that fits the holes in the bosses of the pistons and passes through the eye of the drawbolt.

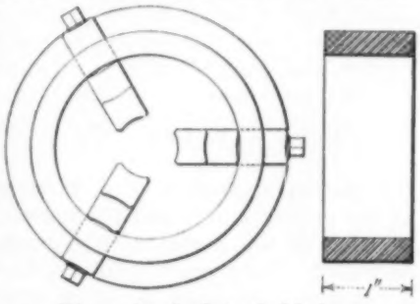
Fig. 2 shows the same principle applied to the construction of an expanding arbor. The parts are identical with the exception of the spring ends off the body and the beveled disk *G* that expands them when the drawbolt is tightened by drawing up the cotter.

Compensating Chuck Jaws—Discussion

BY ARTHUR SILVESTER

On page 744, Vol. 61 of the *American Machinist* there appeared an article by Charles Homewood, under the title given above. Mr. Homewood says that when the jaws of a chuck are worn bell mouthed, they can be made accurate again by the method he describes.

When it is necessary to adopt any such method, I think it is time to discard the chuck, and for the following reasons: It would often take longer to adjust the jaws than to do the work on the job to be chucked. The jaws would have to be annealed and rehardened, rendering cracking possible. All the jaws will be weakened. After the jaws have been repaired, the chuck will not be self centering and will have to be adjusted for each particular job. If a lot of finished bushings were required to have a small amount taken out of the bore, no mechanic could put them in a chuck repaired in the manner described in Mr. Homewood's article and have them run absolutely true.



Ring chucked to hold jaws for grinding

A three-jawed chuck is one of the most difficult things to keep true, especially if it is used by more than one person. No two operators seem to use it alike and it is a common thing to find a chuck badly strained from using a chuck wrench lengthened by a piece of pipe placed over it.

When chuck jaws are out of truth, they should be ground. To do this properly a finished steel collar, about 1-in. wide and having an inside diameter to suit the radius of the jaws at the large step, should be chucked as shown in the sketch. The jaws should be screwed out until the collar is held just fairly tight, taking up any end plan in the jaws. Then proceed to grind. I have found it advantageous to grind the jaws to a slight taper making them smaller at the outside than the inside, since they have a natural tendency to bell mouth, especially when work is very tightly chucked.

IDEAS FROM PRACTICAL MEN

Milling Device for a Turret Lathe

By C. H. Van Fossen

The attachment shown in the accompanying drawing was designed for milling a slot in the end of a casting, while chucked in a hand screw-machine. By means of it, we were able to eliminate a separate operation of milling the slot in another machine, following the lathe work on the casting.

The piece to be machined is a small malleable-iron casting, as shown in Fig. 1. It has a flanged end that is to be faced and turned on the diameter and a cored hole in the center to be drilled and tapped. A slot, resembling a Woodruff keyway, is milled in the end of the casting as shown. Fig. 2 shows the arrangement of the milling cutter and its mechanism, as well as the position of the device with relation to the casting to be milled. The piece is held in a Barker, two-jaw chuck fitted with false jaws, *A*, which extend beyond the face of the chuck and are turned round for a distance back from the end. One of the false jaws is fitted with a square-headed driving pin *B*. The bevel gear *F* has a rectangular flange at the end of its hub, by which it is bolted to the face of the turret, and is bored and fitted with a bronze bushing. At the rear of the flange is an inserted collar that pilots in the hole in the turret-face to locate the tool and also retains yoke, *E*. The yoke *E* has a shank turned down to a running fit in the bushed gear, and is held in place by a washer and nut that run free in the turret hole. The front end of the yoke is a rectangular head upon which is carried the cutter, its arbor and its driving pinion, as well as a guide plate and a driver.

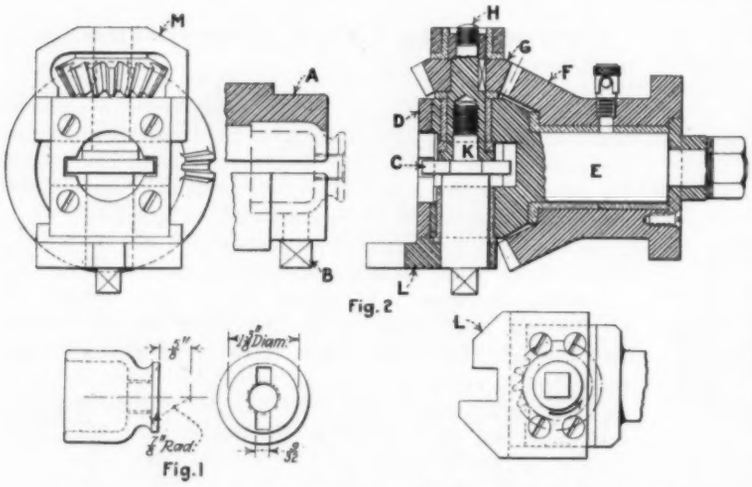


Fig. 1—The work. Fig. 2—The milling attachment

The arbor *H* has its bearing in a bronze bushing pressed into the yoke *E*, and has the bevel pinion *G* keyed to it. The pinion is locked on the arbor by means of a threaded collar that runs in another bushing in the small yoke *M*. This bushing also takes care of the end thrust of the pinion. The cutter *C* is held on the arbor by the screw *K*, the large diameter of which provides an out-board bearing, thus lending additional support to the cutter. The hardened guide-plate *D* is fastened to the front end of yoke *E*, and has a hole which guides the tool to the work in proper alignment. It also has a slot through which the cutter can be removed for sharpening.

In operation, the flanged end of the work is faced off and turned to size and the cored hole is drilled for tapping. Following this, the back-gear clutch is thrown in to reduce the spindle speed, and the turret is fed forward with the milling attachment in position. The driving pin *B* on the chuck jaw, picks up the driving plate *L*, and the cutter is set in motion by the bevel pinion rolling around on the bevel gear. Since the cutter and the work are held in alignment by the square driving-pin entering the slot in the driving plate *L*, and since the cutter is turning on its own axis as it swings around with the work, it follows that a slot will be milled in the face of the flange on the work as the turret is fed forward.

In following through the action of this device, it may be helpful to first imagine the spindle of the machine standing still. When the attachment is brought forward it engages the driving pin *B* in its slot. Now, if instead of remaining stationary, gear *F* were made to turn away from the operator, the arbor and cutter would be driven in the direction indicated by the arrow in the bottom view in Fig. 2, and the cutter would mill its way into the work when fed forward. The action of the cutter with relation to the work, is the same when the spindle and the cutter are turning together and the bevel gear *F* is stationary.

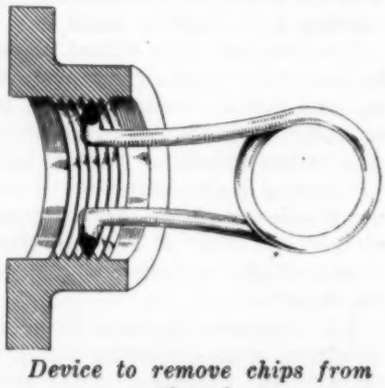
The ratio of the pinion and gear is 2 to 1, so that the milling cutter runs twice as fast as the lathe spindle, producing a fair cutting speed, even though the lathe is run at a slow speed by means of the back gears while the milling is being done.

In the application shown, it was necessary to limit the size of the device so that a 1¾-in. cutter could be used. Since the clearance over the turret slide is small, careful planning was necessary to get the parts strong enough to stand up to the job.

A Cleaner for Faceplate and Chuck Threads

By Charles B. Park

The illustration shows a handy device for cleaning out the threads of faceplates and chucks that are used upon the spindle nose of a lathe. Every lathe worker has at times been exasperated by some small and practically invisible chip that has become jammed in the threads and prevents the plate from being screwed up to the shoulder; or, if it can be screwed up, causing it to run out of true.



Device to remove chips from threads

IDEAS FROM PRACTICAL MEN

The device is made of a piece of spring-steel wire of about ¼ in. diameter with the ends out-turned, hammered flat and filed approximately to match the contour of the threads. It should be left sufficiently "open" so that it must be squeezed quite sharply in order to make it enter the threaded hole, thus holding the points firmly in contact with the threads as the device is turned through.

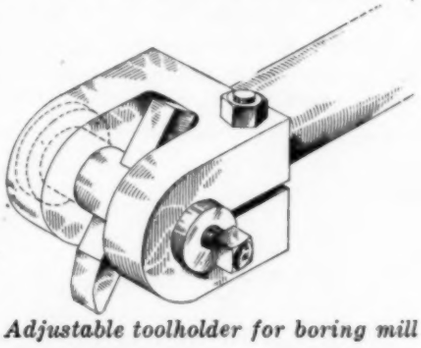
[This is an old device, but a commendable one. We have had several of them of different sizes in our kit for many years. Given a piece of wire of suitable size, one of them can be made and a refractory chip removed with it in less time than is usually expended in "digging" for the same chip with the bent end of a scriber. We would, however, recommend the use of hard brass wire in lieu of steel, as less likely to damage the cast-iron threads.—Ed.]

An Easily Adjustable Boring-Mill Toolholder

BY HERBERT F. CRAWFORD

A jobbing shop that handles a large variety of boring-mill work, uses a number of toolholders like the one shown in the sketch. They are not new but they have proved very useful here and in other places.

The shank of the holder fits into the toolbar of the boring mill. Its end is forked, and through the round hole in the two ears is a round toolpost, very similar to the one used in an engine lathe. A square-headed setscrew in the end holds the tool in the slot of the toolpost in the regular way.



Adjustable toolholder for boring mill

The round body of the toolpost is a neat fit in the ears of the holder. One of the ears is slotted at the upper end and clamps the tool holder against turning, by pinching it at this end.

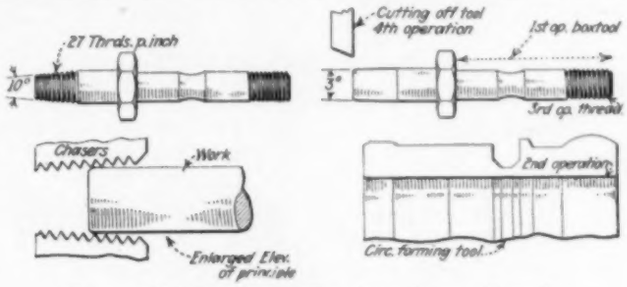
Since the tool is held in the toolpost by an independent screw, it is very easy to swing the tool to any desired angle by merely loosening the clamping bolt in the ear and turning the toolholder as desired, before reclamping.

Cutting Tapered Threads at an Unusually Steep Angle

BY H. J. GUSTAV KOPSCH

Recently I had to make up a few thousand pieces which had a tapered thread having an included angle of 10 degrees. When we ordered chasers for this job the manufacturers of the die-head expressed doubt as to the feasibility of cutting such a fine thread upon so steep an angle, and I quite agreed with them. However, the job had to be done.

The chasers were furnished with an included angle of 10 degrees. The pieces were made, but not threaded, on the automatic screw machine, leaving the part to be threaded a much smaller angle than the threaded part was to be. They were then threaded with an H. & G.



Piece with an unusually steep taper thread

die-head in a Warner & Swasey hand screw machine. The production was 300 pieces per hr. The lubricant used was mineral lard-oil mixed with white lead.

The sketch shows the piece and also an outline of the circular forming tool used on the automatic.

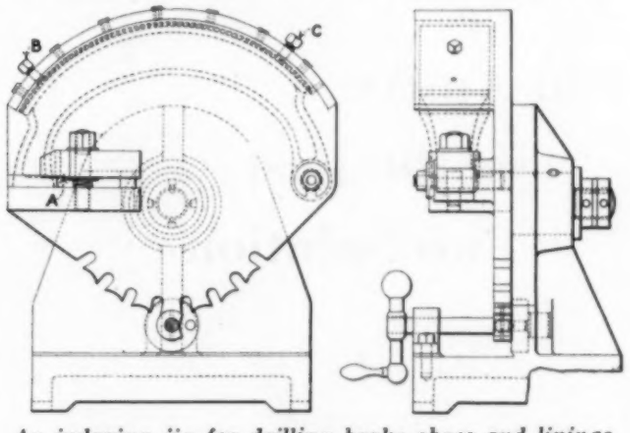
Brake-Shoe Drill Jig

BY ROBERT W. BURGESS

The illustration shows a jig used for drilling the rivet holes in automobile brake shoes and brake linings.

The writer believes it a much faster jig than is commonly used on similar parts and has the advantage of enabling a brake lining to be drilled with each shoe.

The work is located on a stud in the brake-pin hole, and held in place at one end with a C-washer and a nut.



An indexing jig for drilling brake shoes and linings

The opposite end is held with the slotted strap-clamp *A*. The brake lining is held in place by the two ½-in. square-head setscrews *B* and *C*.

The index mechanism is an ordinary Geneva motion which, is very rapid, since but one revolution of the index crank is necessary to index from one hole to another. The indexing mechanism is self locking and has the advantage that while a full revolution of the crank is necessary, a slight over travel is permissible, because no further indexing action can take place until the pin engages the next slot in the index plate. This jig has been used satisfactorily for two years.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

A Gas Engine With Double Pistons

Q. I have invented a double-piston gas engine. Can you tell me whether such an engine is practical? I can send you a drawing or a photograph of the engine with parts shown dismantled. Which would be best?

A. It would, of course, be impossible for us to give an opinion as to the practicability of your engine without knowing more about it. If you will send us a photograph showing the engine, together with the parts dismantled, and a short description of its action and what you claim for it, we may be able to help you determine its practicability.

We suggest, if you have not already done so, that you have your drawings and photographs witnessed and dated for your own protection.

Etching On Steel

Q. Can you tell the process by which names and trade-marks can be etched on hardened tools such as drills and reamers? In the work we have seen, the letters are sharp and clear.

A. We know of no process of etching (except by the use of a stylus, or electric apparatus) that will produce letters that are sharp and clear, and either of these processes is to slow for production work.

The usual method of marking drills and reamers is by rolling them under a die containing the names or letters wanted, before they are hardened. The work is done in a marking machine and the letters are sunk to such a depth that they will not be obliterated by grinding or polishing the marked part.

Chart for Press Work

Q. Can you tell me who publishes a standard chart for punches and dies to be used in blanking tin, lead and steel?

A. We do not know of any such chart as you have reference to. However, if you willl tell us specifically what you want to know, we will be glad to try to help you.

Alferium Tubes

Q. Please advise us where we can get further information regarding tubes made of Alferium, as per the item under the head of Technical Abstracts, published on page 405, Vol. 62, of the American Machinist.

A. We believe your best source of information regarding Alferium tubes will be through the Schneider Works, Le Creusot, France.

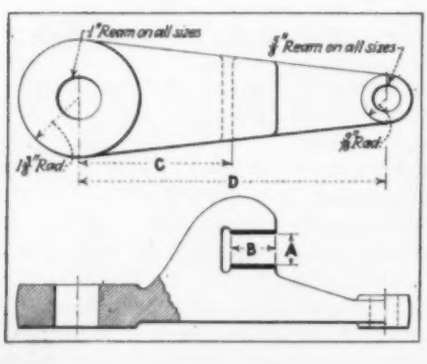
$50 Apiece for the Best Two Solutions

OPEN to all readers of the *American Machinist*. Answers must be mailed by July 1, 1925. Judges—editors of the *American Machinist*. The two winning solutions will be published and discussion will be welcome. Other good solutions will be published and paid for at space rates, the names of the authors to be withheld if they so desire.

Send your solution to Practical Shop Problems Editor, *American Machinist*, 10th Ave. at 36th St., New York City. Put your full name, position and company on the answer in such a way that this information can be detached and a key number substituted.

Don't wait until the last minute to send in your solution.

Conditions of the Problem



Design a fixture to hold the work while the metal indicated by the heavy lines at the dimensions A and B is being removed. Seven sizes as tabulated are to be considered. The fixture may be universal to accommodate all sizes or individual fixtures may be designed to take one or more sizes as may seem desirable. Economy in cost and highest operating efficiency are desired.

Material—Cast iron.

Depth of cut—approximately $\frac{1}{16}$ in.

Total quantity—200,000 yearly (in lots of 5,000 each).

Both ends have been straddle milled and reamed.

Contestants to select method, type of machine tool, small tools and to design fixture. Feeds, speeds cutting time and floor-to-floor time must be given.

A	B	C	D
$\frac{3}{4}$	$\frac{3}{4}$	3	6
$\frac{7}{8}$	$\frac{3}{4}$	$3\frac{1}{4}$	6
$\frac{7}{8}$	$\frac{3}{4}$	$3\frac{1}{16}$	$7\frac{1}{8}$
$\frac{7}{8}$	1	$3\frac{3}{4}$	$7\frac{1}{8}$
$\frac{7}{8}$	1	4	$7\frac{1}{8}$
$\frac{7}{8}$	1	$4\frac{1}{4}$	8
$\frac{7}{8}$	1	$4\frac{1}{4}$	9

Technical Abstracts

Centerless Grinder Operation

In this article describing the work of the Heim grinder, several illustrations are given of the productive capacity of the machine in rates per hour. It also states that in grinding steel it is not advisable to remove more than 0.005 in. or 0.006 in. of material at a pass in the roughing operation, and when it comes to finishing, it is a matter of experiment to a greater or less extent.

It is good practice in grinding such work as piston pins ranging from ⅜ in. to ½ in. in diameter and having 0.012 in. to 0.015 in. of stock to be removed from the diameter, to make two roughing passes, removing about 0.006 in. at each pass, and two finishing passes. In one finishing pass 0.002 in. would be removed and in the last finishing pass not more than 0.0005 in. from the diameter would be removed. This is mentioned in the line of general information.—*Abrasive Industry*, April, p. 102.

Accident Preventions

L. W. Thompson of the Wagner Electric Co., describes how accidents have been practically eliminated from the plant. One important point in the work was to bring about a safety atmosphere throughout the factory, by seeing that no physical safeguard was overlooked. A workman who sees attention paid to safety soon absorbs the safety idea as part of his fundamental thinking. There is a safety man in each department and this man is usually in training for the foremanship. It is found that the safety work does not interfere with his piece-work earnings, and in addition the foreman has the responsibility of maintaining production with the fewest possible accidents.

Safety equipment of punch presses is taken up in detail and the standards are as follows: first, a double-hand trip; second, a pedal guard to prevent accidental tripping; third, a wire guard in front of the die to prevent the use of fingers under the die instead of tweezers; fourth, wing guards as described in the article; fifth, fly-wheel guards; and finally, an enamel sign calling attention to the danger of this machine. Tweezers are used throughout the department and it is stated that an operator becomes very expert in handling material with this tool which is made from strips of brass. Some illustrations are given on how these methods are applied.—*Factory*, March, p. 426.

English Worm Gear Manufacture

The methods used by David Brown & Sons, Huddersfield, England, are described. The worm is of the parallel type and the sides of the thread are not flat, but are of a special curved contour causing the worm to mesh with the wheel in such a way that the greater part of the motion between the two is of a rolling nature. The rubbing velocity is low, so the gear is very durable and has an efficiency of 97.3 per cent.

The worm starts in the form of a steel blank that is turned, and then ground on the journals ready to be secured in the machine that will generate the thread. The thread is cut by a milling cutter set at the correct angle and ground to the profile required. After this process the worm is hardened and it is then passed on to a machine that grinds the journals for a second time. Following these operations the thread itself is ground on a machine similar to the milling machine, but fitted with a grinding wheel in place of the milling cutter.

The worm wheel is a phosphor-bronze casting and is first of all roughed out with a hob, corresponding in form to a tapered worm. Its threads are gashed to produce cutting edges. The worm wheel is mounted on a horizontal revolving table of a machine and the revolving hob is brought into contact with it, the two rotating continuously until all the teeth are cut. The wheel is then passed on to a second machine where it is finished by a similar process, but with an extremely accurate hob ground to shape. No particulars are given of the machines themselves, the description being somewhat general.—*Motor* (England), Jan. 27, p. 1241.

British Rail Sheds

The Running-Shed manager in writing on the general organization of railroad sheds gives some interesting information and mechanical details. Assuming that 50 engines in steam daily are engaged in general work and omitting engines sent away to the shops for general repairs, the size of the fleet required to keep the 50 engines in daily work is estimated at 74.

By the installation of a proper hot-water washing-out plant, engines need be out of steam for only about three hours instead of about twenty hours as is the case with the cold process. The record time that the author knows of is two and three-quarters hours from train to train. In addition the hot-water plant enables the margin of spare engines to be reduced considerably, and this helps materially in keeping down the total fleet of engines.

Considerable space is given to the discussion of the organization. The chief foreman has charge of the breakdown gang in the case of accidents that block the main line, of the discipline of the men under his control, the daily perusal of the drivers' report books, and finally, the inquiry into all major irregularities of working. His principal assistant may be a locomotive inspector recruited either from among the engine drivers or one specially selected from ex-apprentices.

In dealing with the mechanical details it is stated that at one time it was possible to obtain a mileage of 100,000 between general repairs, but today the figure varies between 40,000 and 60,000 miles. The tubes will only last for about 20,000 miles and this is dependent upon the quality of the water that is in general use.

Diagrams of tubes and stays of each engine should be kept in the foreman mechanic's office and on one of them the condition of each stay may be marked by symbols such as "X" for a broken stay, "O" for a small head, "S" for a steam tight etc. —*The Engineer* (England), March 6, p. 260.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

The Ideal Machine Tool Salesman

AMONG certain members of the machine industry the machine tool salesman is dubbed a "peddler." According to the dictionary the use of the term is not apt because a peddler is distinguished from an agent or canvasser by the fact that he carries his goods with him instead of taking orders to be filled later. A mental picture of a planer peddler has its humorous aspects.

Speaking more seriously, however, it is something of an indictment of the machine tool business that its sales representatives should have to go by such a name, even though its use be not widespread. Those shop managers and superintendents whose shops are going to continue to be successful are only too anxious to learn from the machine tool men how they can turn out their product at less cost. If the men that call on them are interested only in making a sale then the designation of peddler is well deserved. Such men can hardly be considered as constructive business builders.

The machine tool salesman who can go to a possible customer with an intelligent solution of one of his most vexing problems is quite another type of man. The fact that he can offer real service indicates that he must have worked hard in studying the customer's needs and the ability of his product to satisfy them. Once he has shown the customer that he can be looked upon as a counsellor to be trusted, his visits will be welcome and his orders will accumulate.

Fortunately for the industry there are many men of this type on the road for machine tool builders. They are a constructive force in the field and they are vitally needed. Would there were more of them.

Legislative Records

STATISTICS of the recently adjourned 68th Congress are illuminating. Of the 17,462 bills and joint resolutions introduced, 1,497 were reported out of committees and 1,100 got through. The total is several thousand short of the number introduced by the preceding Congress.

The fact that so few new laws were added to the stupendous number already on the statute books is a matter of congratulation. On the other hand, the enactment of only nine per cent of the bills introduced indicates clearly that most of them should never have been drawn and that an enormous waste of time and money was involved in their consideration.

Every so often we are moved to wonder why no provision has ever been made to clear the records of the unnecessary and obsolete laws that are still in existence although never enforced. When such figures as those quoted come to our attention we are minded to mention the thought again even though we are sadly convinced that nothing so efficient could ever be put through our greatest deliberative body.

Low Wastage in Metal Industries

SECRETARY HOOVER, who is likely to go down in history as the nemesis and arch-enemy of waste, credits the metal-working industries with being the least wasteful of any in the country. According to tabulations the waste in metal industries is 29 per cent, 12 per cent less than its nearest neighbor, boots and shoes.

In spite of seasonal work, the building trades only show 53 per cent waste while the worst offender is men's clothing at 64 per cent. The waste in the average American business is given as 49 per cent.

Waste does not only mean that of material and of time in the shop but in the duplication of sales effort, bad credits, improper distribution, inefficient loading, and so on.

Let us congratulate ourselves that the metal working industries waste less than any other—and strive to bring the percentage still lower.

Just Suppose

JUST suppose the general staff of the army decided that it was a waste of time to read up about the latest developments in ordnance materials and other munitions of war and that the officers should confine themselves to trying to get the best out of what they had. What do you think would happen when the army met the enemy in battle?

Now suppose the general staff of a factory makes up its mind that reading up about new methods and machines is not only a waste of time but a nuisance besides, because it leads to all kind of demands for things which cost real money; and that the officers in the shop should confine themselves to production and more production and show what they can do with the means they have. What do you think will happen when that concern meets the enemy in competition?

Well, you say, that's not a fair comparison for we don't have real battles in competition now-a-days.

Don't we? Maybe not, but

Just suppose

Shop Equipment News

Bullard Vert-Au-Matic

A single-spindle, vertical, automatic, chucking machine is announced by the Bullard Machine Tool Co., Bridgeport, Conn., as the latest addition to its line of automatic, production-machine tools. It is to be known as the Vert-Au-Matic and is intended for production of chucked work requiring one chucking or a series of single or group operations. This machine is markedly similar to the four-spindle and six-spindle Multi-Au-Matic with which the trade is already familiar, and is, in fact, a standard machine built of standard parts used in the multiple-spindle models. It is one unit of the Multi-Au-Matic without its coordinating control and indexing features which are, of course, unnecessary in a single-spindle machine. The Vert-Au-Matic is at present built in the 8-in. size.

The capacity of work in the 8-in. model includes pieces up to 6 in. in height and swinging 12 in. in diameter. Development work is already completed on this model and will be followed shortly by two larger sizes, the capacities of which will also run parallel to the Mult-Au-Matic; namely: the 12-in. size taking work 6 in. high swinging 16 in. in diameter, and the 16-in. size taking work 6 in. high swinging 21 in. in diameter.

The construction of the Vert-Au-Matic makes use of standard Bullard units. The workspindle is of standard design with self-centering, conical, thrust bearing under the spindle head and two cylindrical bearings of large diameter and proportionate length to absorb side strain. The spindle drive is derived by shaft and spur gears from the standard, Bullard Mult-Au-Matic feed-works located in the head of the machine and from which point spindle speeds are determined by change gears which provide twenty-three possible changes ranging from 33 to 300 revolutions per minute.

The feed-works, as in the Mult-Au-Matic, also provides in the same manner for twenty-three possible feed changes for the main head ranging from 0.0,067 to 0.06 in. per revolution of the spindle.

The main toolhead is designed for vertical motion only and is similar in construction to the plain head of the Mult-Au-Matic except in length of stroke. The full distance of toolhead travel is 9 in. which, by limiting the capacity of the machine to work that is 6 in. high allows 3 in. of clearance for chucking. This head may also be equipped with a drill spindle having a capacity up to 1¼ in. in diameter. The spindle is bored for No. 3 Morse taper shank.

One feature of the Vert-Au-Matic is the supplementary side head similar to that used on the four-spindle Mult-Au-Matic. This device consists of a heavy bracket firmly secured to a scraped bearing on the column and vertically adjustable in height sufficient to provide for its application to any required operations on work within the range of the machine. On this bracket is mounted a swivel and toolslide capable of 4 in. of vertical, horizontal or angular tool feed, while within it is the actuating mechanism which provides rates of feed in direct relation to the main head feed. The feed ratio is determined by change gears in the bracket easily accessible from the rear of the head. This arrangement brings into operation two independent toolheads in combination with a drillhead when it is required.

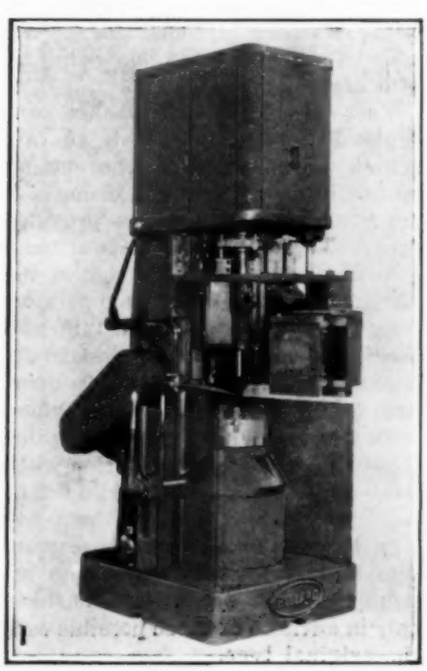
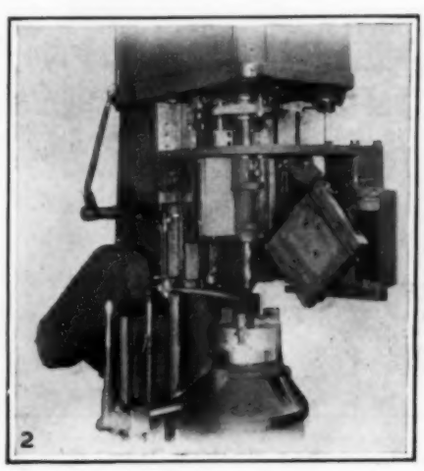
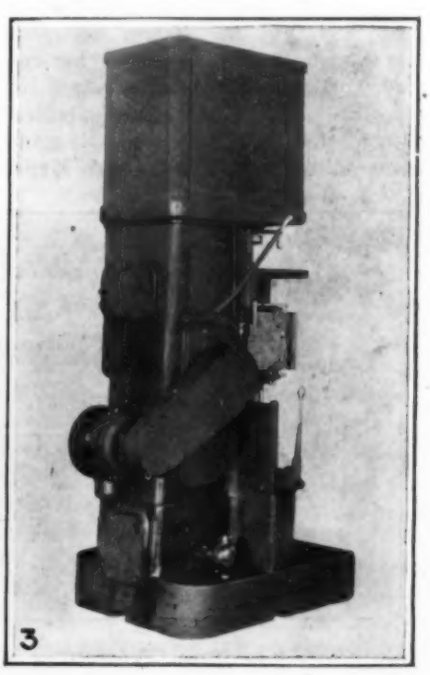


Fig. 1—Bullard Vert-Au-Matic

Fig. 2—A detail view of chuck and heads

Fig. 3—Rear view showing standard motor mounting





SHOP EQUIPMENT NEWS

A second feature consists of a power chucking device, a recent Bullard unit which has been successfully applied to Mult-Au-Matic and Contin-U-Matic workspindles for mechanically actuating chuck jaws or holding fixtures. The Bullard power chuck on the Vert-Au-Matic is an appreciable time and effort saver, for by simply throwing the chuck lever in either direction, the jaws are respectively closed or released by power; the time required for operation being two seconds. The device provides a positive grip, mechanically maintained. It is a part of the machine itself and is not dependent upon outside sources for actuating or holding. Adjustment within the device is provided for jaw tension so that work may be held as required, avoiding any distortion from overclamping.

The cycle of machine operation starts with placing a rough piece in the chuck and throwing the chuck lever. Then by tripping the clutch lever, power is applied to the spindle and the toolheads are advanced rapidly to the point of cutting, are fed through the cut, and quickly returned to where the clutch is disengaged by automatic control. One operator may therefore attend as many machines as the time of the automatic cycle will permit. There is no productive effort required on his part except in placing and removing the work and in manipulating the chuck and clutch levers, nor has he any control of machining functions after the job is set up.

A constant flood of oil is circulated for lubrication from a reservoir in the base by a pump which is directly and continuously driven from the constant-speed main shaft. The oil is forced to the top of the machine passing through a filter which removes all impurities and foreign matter. From this point it is fed by gravity to all the inclosed operating units of the machine, supplying an ample flow of clean, pure oil to all gears and bearings.

There is also a marked convenience in operation by placing Vert-Au-Matics in battery, side by side, for the operating space required from spindle to spindle is less than 4 ft. The projected floor space is 45 in. wide by 50 in. front to rear and the machine stands 102 in. in height.

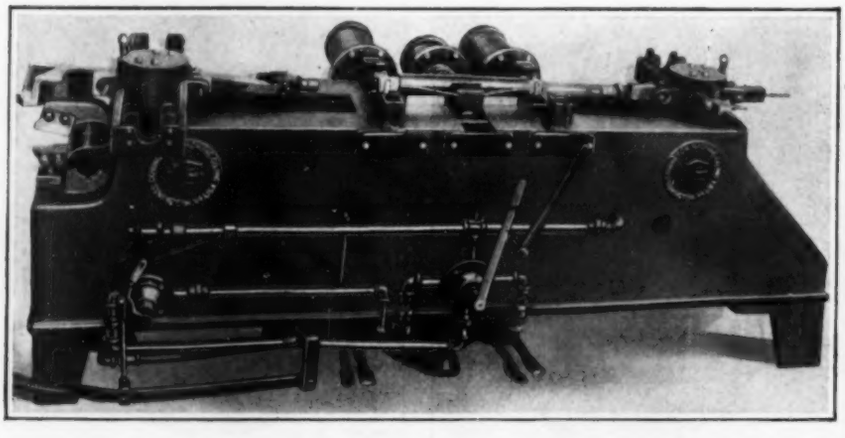
The power required is, of course, proportional to the work, but in most cases, the 8-in. Vert-Au-Matic operates satisfactorily with 5 hp. The machine may be driven from a counter shaft or by a constant-speed, belt-connected motor. Standard construction, however, provides for individual motor drive with chain connection to the main shaft which should run at 760 r.p.m., therefore, either an a.c. or d.c. motor of 5 hp. with a constant speed of approximately 1,200 r.p.m. is satisfactory. A pad for motor mounting is provided on the back of the column adaptable to the types of motors available as illustrated in Fig. 3. Allowance should be made in floor space for some overhang of the motor which, of course, varies with the type chosen. A power switch may be conveniently mounted on the left-hand side of the column within easy reach of the operator so he may stop the motor from his working position.

Covington Hose-Dismantling and Assembling Machine Type "B"

The Covington Machine Co., Covington, Ky., has redesigned its original machine, previously described on page 283, Vol. 55, of the *American Machinist*, and is offering an improved Type "B," as illustrated, for the trade. The methods of application of this type for dismantling and assembling air, steam and signal hose and fittings, have been improved and speeded up over the preceding design.

Openings have been cored in the frame through the top leading to the rear, under which boxes can be placed to catch old parts as they are stripped.

The knife block and arm, at the left end, for cutting clamp bolts have been lowered to clear a sliding turret at that end. Two of these turrets, which revolve as well as slide on their ways, carry all of the dismantling and assembling tools, arranged in the correct sequence. A 6-in. clamping cylinder has been added for holding the hose while it is being worked on.



Covington Hose-Dismantling and Assembling Machine Type "B"

Foot and hand controls are conveniently located to operate the air cylinders, for actuating the cutting knife, the turret and the clamp. A number of special jaws are provided for certain uses and are kept at hand in two stands that set in front of the machine on each side of the operator.

It is said that under actual test one man dismantled 240 standard air hose in an hour from floor to floor, and 200 signal hose in an equal amount of time. Steam hose, which is usually in very bad condition when received for dismantling, could not be recorded for that reason. Forty-five signal hose or 35 steam hose were found to be an hour's work on assembly. These speeds are considerably in advance of those possible with the original type.

SHOP EQUIPMENT NEWS

Rockford Drilling Machine Co. Stickney Universal Unit

A universal power unit that includes hand or automatic control of all movements for single- or multiple-spindle drilling, tapping, boring, reaming and facing operations has been developed by the Rockford Drilling Machine Co., Rockford, Ill., and added to the company's other lines of drilling machinery. The unit consists of the head with integral square ways, fitted to slide on a horizontal base, as illustrated, or on a vertical column. It is intended for the universal application of auxiliary toolheads, a sub-base and a rigid, rotary, or drum-type table, either plain or automatic, as may be required to best suit the work to be done.

The company is prepared to furnish to specifications fixed-center or adjustable-spindle drill heads with any number of spindles and any drilling area within the capacity of the motor to drive. The company is also in position to design and build complete equipment that includes the jigs and tools as well as the assembled unit, ways and worktable.

The motor, which is part of the equipment, is mounted on top of the head and drives the spindle through heat-treated, alloy-steel, pick-off change spur gears inclosed in a tight case and flood lubricated. There are no splined shafts. SKF self-aligning, annular ball bearings are provided for the high-speed shafts while all others are bronze bushed. The pick-off change gears allow a wide range of speeds to be set, while a lever control on the head operates a jaw clutch to give two speeds, one two-thirds of the other, for each change-gear combination.

The drive is taken for the feed from the main spindle through another set of flood-lubricated pick-off change spur gears and interposed jaw clutches. Another control lever operating a dive key provides three feeds for each setting. Drilling feeds from 0.004 to 0.048 in. can be secured without compounding, as can tapping feeds from 12 to 32 pitch. Back feeds are also available by combinations of the change gears.

The feed-change gears drive a bronze nut which is equipped with ball-thrust bearings and flood lubricated to accomplish the power-feed and rapid-travel movements by turning on a steel screw mounted in the bed. This screw is extended and fitted with a wormwheel that meshes with a worm and handwheel which serve to hold the screw stationary except when it is desired to move the head by hand. With the power feed thrown out for this purpose, the handwheel is then used to move the screw in the stationary nut for setting up or for spot facing. An auxiliary motor can be furnished to move the head on its ways when the spindles are not rotating.

There are two automatic cycles which can be set when desired as follows:

1. In drilling, reaming and boring, the starting handlever is tripped for —rapid advance to the work—change to power fed through the work—rapid return—stop at end of cycle.

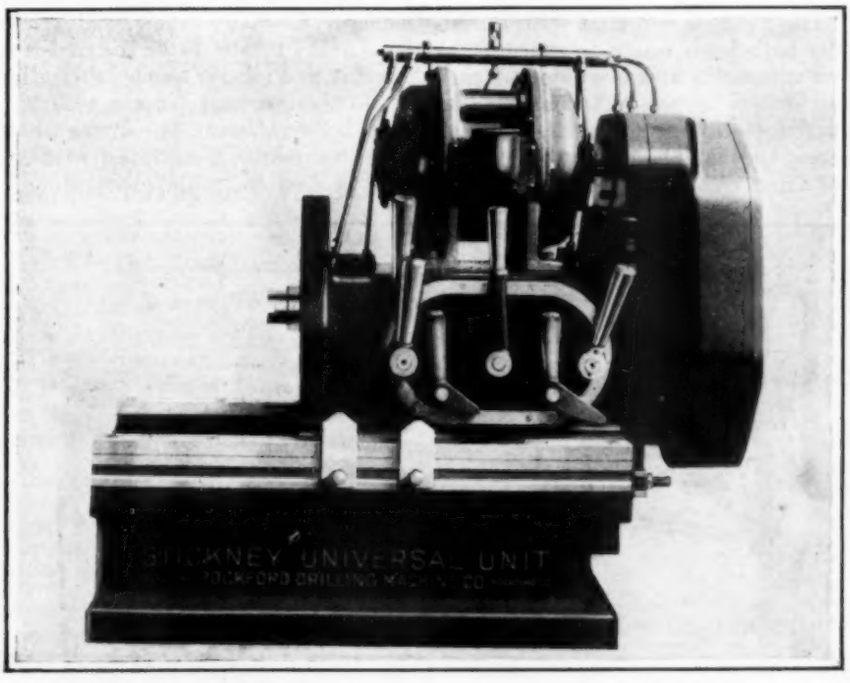
2. In tapping the starting handlever is tripped for—rapid advance—change to power feed—spindle reverse—rapid return—stop at end of cycle.

The spindle reverse is accomplished by reversing the leads to the motor with a cross-the-line switch.

Oil from the various points where it is used to lubricate runs to a sump, where it goes through a filter and is then picked up by a pump and forced through the injectors again.

Cutting lubricant is held in a tank in the base from which it is pumped on the work and returned in channels in the work supports. One motor in the base drives both of the pumps.

The unit is built in five sizes, known as Nos. 0, 1, 2, 3 and 4, which are equipped respectively with 3-, 5-, 10-, 15- and 25-hp. motors. With even-change gearing, the normal speeds are in the same order, 500, 400, 350, 300 and specification. The size of the Morse taper is 2, 4, 5, 5 and specification. * By changing these gears, any speed from half- to double normal is available.



Rockford Drilling Machine Co. Stickney Universal Unit

Leitz Binocular Stereo Magnifier

A magnifier designed to assist in observing and checking precision work is announced by E. Leitz, Inc., 60 East 10th St., New York, N. Y. It consists of a binocular, prism body which can be furnished for high- or low-power magnification, a rack and pinion slider for use in attaching the instrument to a support, and a pair of eye pieces. A variety of supports or stands are listed for application to varying machine and bench operations. One of the models, comprising the instrument mounted on a

SHOP EQUIPMENT NEWS

stand for bench work and known as Model BSM-1, is illustrated.

The magnifier produces a stereoscopic image, placing the object in plastic relief, and has a range of magnification from 3.5 to 30 diameters. The working distance from the prism body to the specimen is dependent on the magnification used and varies up to 6 in. An object 2 in. in diameter which can be covered with the low-powered eye pieces, decreases slightly in size as the higher magnifications are resorted to. There are three of the eye-piece sets which are used for different degrees of magnification. They are designed so that one of each pair is adjustable to compensate for

Leitz Binocular Stereo Magnifier

any difference in right- and left-hand eye vision.

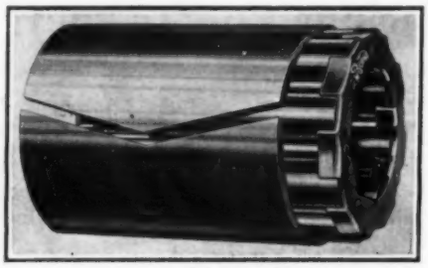
A ball-socket stage, known as BSM-Z, is furnished to specification for holding objects to be closely examined at various angles.

Bond Commercial Roller Bearing

The roller bearing illustrated is being manufactured by the Bond Foundry & Machine Co., Manheim, Lancaster Co., Pa., for use in all classes of machinery and equipment where roller bearings can be applied.

It consists of solid-steel rollers which are hardened and ground and a pair of pressed-steel retainers, tied, spaced and held rigidly in exact alignment by stay rods which alternate with the rollers and are electrically welded into the retainers. A split outer race made of high-carbon steel is included or omitted to specification. The V-cut in the race is designed to present a continuous surface as a path for the rollers.

The bearing is available in a variety of sizes listed in two styles.



Bond Commercial Roller Bearing

One style for medium duty takes in a range from $\frac{3}{4}$- to 3-in. shafts, while the other for heavy duty extends the upper limit to 4 in. The lengths of both vary in 1-in. steps from 1 to 7 in. Roller diameters are from $\frac{1}{2}$ to $\frac{3}{4}$ in., in the first, and $\frac{1}{2}$ to $1\frac{1}{8}$ in. in the heavy-duty style. The company furnishes a complete range list on request and an accompanying set of load tables to assist in determining the proper size and style for a given duty.

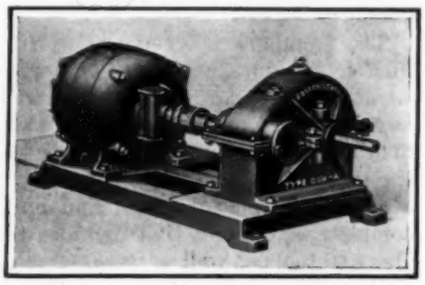
Niagara Foot-Operated Squaring Shear No. 1120-F

The Niagara Machine and Tool Works, 683 Northland Ave., Buffalo, N. Y., has added the shear illustrated to its other lines for sheet-metal working. It has a capacity for cutting mild-steel sheets which are not longer than 120 in. or thicker than 18 gage.

The shear is equipped with a positive hold-down which is operated by two eccentrics and is guided at each end on the upper-knife bar by machined pads. A patented, parallel-screw, adjustable back-gage can be set from either end of the machine. The upper-knife bar is built as a truss and contains a steel stiffener under constant tension. There are no counterweights. A treadle is set the entire length of the frame so it is accessible when cutting large sheets. Balanced distribution of metal and design to permit easy operation have been featured.

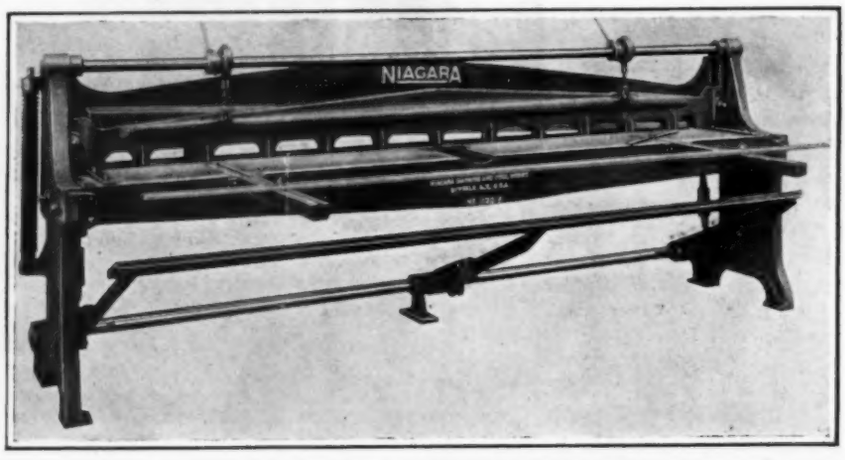
Boston Gear Works Speed-Reduction Unit, Type GUH-A

A series of standardized, combination, speed-reduction units similar to the one illustrated is announced by the Boston Gear Works Sales Co., Norfolk Downs, Mass. The unit is designed for obtaining high speed



Boston Gear Works Speed-Reduction Unit, Type GUH-A

reductions within a small operating space, and is constructed for mounting on a base and to be driven by a General Electric motor. Herringbone gears rotate inside the cast-iron housing and receive ample lubrication as do the bearings from a reservoir just below them. The drive shaft from the motor is equipped with the Boston flexible insulated coupling.



Niagara Foot-Operated Squaring Shear No. 1120-F

News of the Week

Spring Meeting Program Reveals Study of Many Vital Problems

A. S. M. E. will discuss diversity of subjects in Milwaukee

The technical program for the Milwaukee spring meeting of the American Society of Mechanical Engineers brings forth a number of excellent papers on diversified problems of great importance to mechanical engineers in all industries. The technical sessions will be held during the mornings of Tuesday, Wednesday and Thursday, May 19, 20 and 21, 1925. All the meetings will be held in the Hotel Pfister, the headquarters for the meeting.

An important public hearing of the Boiler Code Committee will be held on Monday afternoon, May 18. The National Board of Boiler and Pressure Vessel Inspectors will meet simultaneously in Milwaukee and the members of the National Board have accepted the invitation to be present at this public hearing and also at the deliberations of the Boiler Code Committee during the week.

The technical sessions on Tuesday morning will be devoted to fuels, hydro-electric operation, machine-shop practice, and forest products.

Machine Shop Session

The program for the Machine Shop Session will bring out new information on the form of cutting tools and reveal the results of an interesting research program carried out in Germany by Dr. Klopstock. Joseph K. Wood, Chairman of the A.S.M.E. Research Committee on Springs, will present a Code of Design for Mechanical Springs in which he will put to practical use the formulas he presented at the 1924 annual meeting of the society. Defects in heavy forgings will be taken up by J. Fletcher Harper who will point out how defects may be avoided by adopting proper methods of design and manufacture.

The Forest Products Session will be devoted to a consideration of the importance of standardizing hardwood lumber and the need of a nation-wide policy of reforestation. Three interesting papers will be presented.

On Tuesday evening there will be a session devoted to engineering developments in Milwaukee. After thirteen years of experimentation, Milwaukee has completed a sewage-disposal plant that presents a great many interesting problems which will be discussed by John A. Wilson and Robert Cramer.

The Wednesday morning sessions will be devoted to industrial power, materials, materials handling, and national defense.

The National Defense Session will be given over to an informal discussion of the engineering problems of industrial preparedness. At the Materials Session two exceedingly important papers will be presented. One will reveal the value of the X-ray for investigating steel castings as shown from the results of the study of the drum to be used for the 1,200-lb. boiler to be installed in the Weymouth Station of the Edison Electric Illuminating Co. of Boston. The second paper will report the properties of aluminum and its alloys in a form that may be readily used by mechanical engineers for design purposes.

Materials Handling

The Materials Handling Division has been working steadily for the past three years in an effort to develop a formula for a comparison of the savings that may be secured by various types of handling equipment. The work of the Division on this subject is in final form and a paper will be presented by James A. Shepard and George E. Hagemann, chairman and secretary, respectively, of the Materials Handling Division. Discussion of this paper in the form of solutions of the formula will be presented by George Langford, E. H. Lichtenberg, and R. J. Wadd.

The Thursday morning sessions will be taken up with steam power, management, railroads, and apprenticeship.

The Management Session will be directed toward foundry operation, one paper dealing with steel-foundry management and the second with gray-iron foundries.

The Railroad Session will take up maintenance problems, one paper treating the economics of repairing steam locomotives and the second dealing with freight cars.

The Apprenticeship Session, held under the auspices of the Committee on Education and Training for the Industries, will discuss the Milwaukee district apprenticeship scheme and a proposed nation-wide apprenticeship scheme.

The members of the society who are interested in power problems will find many sessions of interest throughout the meeting. On Tuesday morning there will be a Fuels Session which will give thorough consideration to the problems of furnace design for burning pulverized fuel. Paralleling the Fuels Session on Tuesday morning there will be a Session on Hydro-Electric Design and Operation when one paper on "Parallel Operation of Steam and Hydraulic Plants," will be presented by F. A. Allner based on his experience at Holtwood, Pa. The second paper will deal with hydro-electric operation by E. A. Dow who will speak from his experience with the Davis Bridge plant. William M. White will deal wil mechanical problems of hydraulic-turbine design.

Industrial power problems will be taken up on Wednesday morning in the session at which Arnold Lack's paper on "Torsional Vibration and Critical Speeds of Shafts," will be presented by C. B. Jahnke, and by George Barrus who will present "Tests on Uniflow Engines."

The Steam Power Session Thursday morning will have five papers. W. A. Carter and E. T. Cope will discuss steam-pipe insulation on the basis of research on this subject in the plants of the Detroit Edison Co. Hans Dahlstrand will report recent developments in steam turbines. Prof. A. G. Christie of Johns Hopkins University will present results of a recent study looking to the use of the deeper layers of lake water for condenser purposes. William L. DeBaufre will present a paper, "An Analysis of Power-Plant Performance," based on the second law of thermodynamics and M. K. Drewry will compare actual performance at the Lakeside Station with the theoretical possibilities.

Annual Reports

The following corporations have recently made their annual reports:

The General Electric Co. shows net sales during 1924 of $299,251,869 as compared with $271,309,695 in 1923. The surplus available for dividends amounts to $39,235,548 as compared with $33,525,118 in 1923.

The Westinghouse Air Brake Co. shows a net income of $6,077,928 in 1924 as compared with $10,274,129 reported in 1923.

The International Harvester Co. reports a net profit of $13,037,395 in 1924 as compared with $10,274,376 in 1923.

The Ingersoll-Rand Co. reports a net income of $4,454,623 earned during 1924 as compared with $5,971,138 earned in 1923.

Ford's Property at Chester

The Ford Motor Co. has acquired from the Harriman interests the Chester, Pa., plant of the Merchants-Sterling Corporation, formerly known as the Roach Shipyard. This is one of the pioneer shipyards in the country and was acquired by the Harriman interests in 1917. At peak operations during the war the plant employed about 5,000 men, but of late the property has been idle. It is understood $1,000,000 was paid for the property.

Determining Wages for British Workers

Much dissatisfaction among employees in many trades—Automobile business greatly improved—Machine tool trade not as good as anticipated in January

By Our London Correspondent

COMPETENT judges continue to assert that trade generally has taken an upward turn. But the sun of prosperity has once again postponed its rising on the British machine tool industry. On the contrary, storms seem to be gathering, although it is thought that the clouds may be dispersed.

For some time past employees have been agitating for an increase in wages and it is unquestionable that the employers on their side, seeing the great disparity between what their skilled workers receive and the wages paid to unskilled persons in other occupations, have a considerable measure of sympathy with the demand. All the same they have had to refuse, or at any rate have had to request the representatives of the employees to state in what way they are prepared to offset or balance any increase. The workers, however, will make no concession, and at present a deadlock exists.

The machinists are not the only workers who are dissatisfied. The coal miners are also working for low wages, though their earnings are considerably above pre-war rates and their hours have been reduced. The cost of production, therefore, is greatly increased, particularly as hourly output per worker has declined. Railway workers, too, are demanding advances, the justification for which it is sometimes difficult to see, and the railway companies have no hesitation in asserting their inability to pay what is asked. According to calculation, the increased cost would almost equal the total pre-war wages paid. Apparently an attempt is to be made once more to bring the disputes to a head simultaneously, involving something approaching a general strike.

LOW WAGES

If in relation to other trades and the cost of living generally, the wage rates of workers in the engineering trades are low, those of shipbuilding workers are certainly lower, and a state of unrest also prevails in that industry.

Nevertheless in some directions British shipbuilders are finding great difficulty in competing with the Continent, particularly with Holland, Scandinavia and Germany and, in some cases, France. One or two instances of lost contracts have been made public, and the newspapers have held an inquest on British shipbuilding, often to draw the moral that better organization is required. A leading case is the loss of an order for five motor-ships each of 10,000 tons deadweight, the difference between the accepted German offer and the lowest British tender reaching approximately £60,000 per ship, or a total of £300,000. The order was given by a British firm, on whose behalf it has been stated that, looking at depreciation alone, £15,000 will be saved during the first year of the running of the vessels.

The shipbuilding worker, unlike one or two branches of engineering, has little of the protection due to sentiment. As soon as a municipality finds that electrical machinery can be obtained at a lower price from a firm abroad, the argument is brought forward that the difference would not nearly compensate for the loss of home employment with its cost in doles.

One cause for the depression in shipbuilding has been held by a prominent member of the industry to lie in the Washington Convention that fixed a limit to the number of vessels to be built for war purposes. Yet the people who reason in this manner would be among the first to complain of the present heavy taxation to be rendered still heavier by further expenditures for war purposes.

GERMAN COMPETITION

It is admitted that German costs are lower and that from the Continent quicker delivery may be obtained, though it is still held that British yards excel in quality. The opposition to the use of improved machinery is mentioned, and a leading shipbuilder stated recently that it took 15 years to get pneumatic riveting into his yard. At the same time, he made a special appeal to the workmen not to obstruct the introduction of the one-man punch table from America.

The motor car industry forms a marked contrast with the other branches of British activity and—more particularly regarding light cars—the production is often up to the capacity of the shops and is being increased. In fact in some cases sales outrun production. One of the larger firms in this direction some weeks ago exceeded 1,300 cars a week, and had made every preparation for a steadily increasing output.

Not long ago imports clearly exceeded exports of automobiles, but the pessimistic views held by some of the leaders of this industry on the probable result of the abandonment of the war time duty on imported cars maintained until the middle of last year, have been completely falsified. When comparisons are made it is found that the value of exports of cars and parts, amounting to just under four million pounds in the recent six months, clearly exceeded the corresponding net imports. The position during the coming year seems likely to be more than maintained, for exports promise to increase again. The phenomenon will be found more noteworthy when it is remembered that only two years ago imports were worth more than double the exports, and during the post-war boom nearly reached three times the value of exports.

One motor car firm during the last year or so has completely revised its production system, applying the line method of machining, but placing the whole series of tools for the production of a given unit on a single frame. Thus the cylinder block machine consists essentially of a cast-iron wall more than 180 ft. long by 11 ft. high, on which are bolted a series of machine tools, each for a special purpose. The output is at the rate of one cylinder block in four minutes, the total time for all operations on the block being 224 minutes. There are 53 operation stages, the combined machine bearing 81 electric motors giving a total of 267 horsepower.

For the machine tool industry the year opened with hopeful prospects, but the performance has not been equal to the promise. Railway company orders are on a much lower scale, and complaints are made that even the relatively prosperous electrical section of engineering is content to employ machinery of lower capacity than the market offers, while the motor car industry, that has certainly been a good friend to the machine tool man for a considerable period, is now busier on production than on the reorganization of machining methods.

During the whole of the slump period, small tools appear to have been in relatively greater demand than machine tools.

NO EXHIBIT UNTIL 1928

The general view of the future may be gaged from the fact that at its annual meeting, the Machine Tool Trades' Association recently decided not to hold another exhibition until 1928. The annual report showed that the loss on the exhibition held in London last September was higher than had been anticipated, working out at £347. Not all the members exhibited, and applications from firms outside the association were smaller in number than usual, while "the attendance was considerably less than anticipated." In addition, the statement of income and expenditure showed a balance on the wrong side of about £1,191.

Summarizing the recent condition of other branches of engineering, it may be added that revival in the agricultural machinery section continues to be slow, that some firms at least report better export orders for sugar machinery, and that while the condition of marine engineering and shipbuilding generally is unsatisfactory, it varies with districts, one center reporting the outlook as "worse than for many years," while another mentions that trade is being maintained fairly well.

Personals

MASON BRITTON, vice-president of the McGraw-Hill Co. and manager of the *American Machinist*, sailed April 11 on the Leviathan for a short business trip abroad.

HENRY PIERLE of the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio, returned recently from a business trip to Europe.

MESSRS. ALVERMANN and LAUTENBUSCH, directors of the Phoenix Works, Dusseldorf, Germany, arrived in this country April 11. They will make their headquarters while here at the office of R. S. Stokvis & Sons, 17 Battery Place, New York, and will visit many important iron works.

R. T. PALMER has been made general manager of the Joy Machine Co., Franklin, Pa. He is the treasurer of the Joy Manufacturing Co.

HERMAN SCHWARZE has been added to the organization of the Oakland Motor Car Co., Pontiac, Mich., as an electrical engineer. He was formerly connected with the manufacture of the Cadillac and the Peerless automobiles.

FRANK G. PAYSON has been made general manager of the Logansport Machine Co., Logansport, Ind.

F. J. LEYERLE has been appointed assistant to the president of the H. H. Franklin Manufacturing Co., Syracuse, N. Y., and has already assumed his executive department duties. Mr. Leyerle's connection with the Franklin company dates from March, 1921, when he became service manager.

JOHN P. MCLAREN has formed the McLaren Screw Products Co., 514-522 Fifteenth St., Detroit, Mich. He was formerly with the firm of Brown, McLaren & Co., Detroit.

MARC STERN severed his connection with the Doehler Die-Casting Co. on April 15 after thirteen years of service in the capacity of chief engineer. During the past year he acted as technical representative in connection with the sales department.

FRANK P. CALLAGHAN, chief engineer for the Foote Bros. Gear & Machine Co., Chicago, left April 4 for Cuba on a business trip involving engineering work for the company in that territory.

HERBERT W. COE, works manager of the Waterbury, Conn., branch of the American Brass Co., has been elected president of the Ansonia Clock Co.

FRED C. SCHREIBER has joined the sales force of the Chicago office of Manning, Maxwell & Moore, New York. He was formerly with the Stocker-Rumley-Wachs Co., Chicago.

FRED C. ROBIE has resigned from the factory section of the advisory staff of the General Motors Corporation, Detroit.

ROBERT E. HALL has resigned his position as manager of the pump division of Fairbanks, Morse & Co., Chicago, to become vice-president, general manager and director of the Victaulic Co. of America, New York City.

DR. CHARLES E. LUCKE, head of the department of mechanical engineering at Columbia University, has been retained as consultant for the Babcock & Wilcox Co.

THOMAS E. DURBAN has rejoined the Erie City Iron Works, that he left at the time of the War, to direct its sales and act as advisory engineer. L. V. Reese, general manager of the company, has been elected secretary in addition to his other duties.

WILLIAM PESTELL, who has been connected with the sale of Riley Stokers ever since the formation of the Riley Stoker Corporation, has been made a vice-president of the corporation. He will continue his supervision of all sales.

JAMES L. HAYNES has resigned his position with the Allen & Billmyre Co. to become industrial-engineering specialist with the Hyatt Roller Bearing Co., Harrison, N. J.

ALFRED H. FELDMANN is doing experimental engineering for the Zenith Detroit Corporation in Detroit. He was formerly with the Harley-Davison Motor Co. in Milwaukee.

WILLIAM BEACRAFT, manager of factory 11 of the Buick Motor Co., Flint, Mich., has retired after 21 years of continuous service with the company. He was the oldest employee in point of service on the Buick roster.

WILLIAM R. WILSON, former president of the Maxwell Motor Corporation, has been elected president of Copeland Products, Inc., Flint, Mich., manufacturer of ice machines and refrigerators.

W. R. MILNER has been added to the organization of the Oakland Motor Car Co., Pontiac, Mich., as a body engineer. He was formerly connected with the manufacture of the Cadillac, the Peerless, the Studebaker automobiles, and Liberty motors.

W. F. ARMSTRONG, formerly of the Remy Electric Co., has become production manager of the Olds Motor Works, Detroit. He succeeds HUGH C. DUNNING, former vice-president, who resigned.

Obituaries

HERMAN F. BRANDES, aged 62 years, president and treasurer of the Springfield Manufacturing Co., Bridgeport, Conn., died April 8. He was with the Bullard Machine Tool Co., twenty-five years and was superintendent several years. In 1909 he purchased the Springfield Manufacturing Co.

FRANK S. BALDWIN died at Morristown, N. J. Mr. Baldwin was the inventor of the first adding machine to be marketed in the United States as well as the Monroe calculating machine. He was the chief experimental engineer and a stockholder of the Monroe Calculating Machine Co., Orange, N. J.

JAMES W. GRANT, retired inventor and manufacturer, died in Bridgeport, Conn. He organized and was president of the Special Machinery Co., Bridgeport, for more than twenty-five years.

MASON DECKER, aged 48 years, died in Bayonne, N. J. He was the chief engineer of the Bergen Point Iron Works, Bayonne.

Business Items

Stockholders of the Lumen Bearing Co., Youngstown, Ohio, have announced the sale of this concern to the Falcon Bronze Co. This company will acquire the property, good will and other assets. The Falcon company also acquires in the deal the New Process Copper Co. of Pittsburg, that was owned by the Lumen company.

Arrangements are being made to move the General Motors Research Corporation from Dayton, Ohio, to the General Motors Laboratories, Detroit. The object is to provide closer co-ordination with the engineering departments of the car and truck divisions of the corporation.

The San Francisco office of Manning, Maxwell & Moore, New York, has been moved from 40 Fremont St., to the Rialto Building.

The Modern Reamer Specialty Co., Millersburg, Pa., has been formed for the purpose of manufacturing special reamers and tools of modern design. Production will be commenced May 1 with the making of helical flute expansion and adjustable reamers.

The Oesterlein Machine Co., Cincinnati, Ohio, has purchased the patterns and good will for the manufacture of the upright drills formerly made by the Aurora Tool Works, Aurora, Ind.

The Foote Bros. Gear & Machine Co., Chicago, has recently opened a new sales office in Providence, R. I., to handle business throughout the New England states. The office is in charge of George Walsh and is located at 72 Ontario St., Providence.

The former Saginaw Sheet Metal Works plant of Saginaw, Mich., purchased some time ago by the National Motors Co., has been bought by John P. Booz, of Chicago, representing bondholders of the company.

The General Motors Corporation reports a net profit of $55,723,876 for the year 1924 as compared with $76,642,964 reported in 1923.

The Mid-City Auto Devices Co., Chicago, has been organized by Rudolph Cony, formerly the president of the Sterling Auto Devices Co., Chicago.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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THE dark always seems most intense just after a bright light is turned off, but in a short time our eyes become accustomed to the change and the blackness seems less gloomy and oppressive as our sight commences to pierce it. So a decline in the markets always appears most severe when it follows a prolonged advance, but after the shock has worn off we begin to see it in its proper perspective as the correction of an injudicious speculation and confidence again begins to rule.

The reactionary tendency in stocks and the major commodities that had its inception in the collapse of grain prices a month or so ago gave evidence last week of having run its course for the time being. Interest in the speculative markets has tapered off. Stock trading on the New York exchange has fallen below a million shares daily, though last fall the enthusiastic participants were predicting that the turnover would reach three million shares daily this spring. Fluctuations have kept within a narrower range than Wall Street has been accustomed to since the "Coolidge boom" got under way.

Commodity markets have become fairly well stabilized. Wheat and corn have made some recovery from the low levels recently established and they are now nearing the period when they will be more influenced by prospects for the new crop than by the old crop supply and demand. The season's first government estimate of the winter wheat crop places the condition at only 68.7 and indicates a yield of only 474,255,000 bushels, as compared with 590,037,000 last year; thus far at least this offers no hope of restoring world stocks to a more comfortable size, and the farmers whose crop has been cut down by frost will have to be compensated by a correspondingly higher price.

Wool is steady, copper is a trifle firmer on the showing of reduced stocks, decreased production and increased shipments made by the statistics for the first quarter, and rubber shows plenty of recuperative power based on the near-record activity of the tire companies. In fact the price structure, so far as raw materials are concerned, seems nearer the desideratum of stabilization than it has been in a long time, and the prophecies of those who declare that cautious buying is assurance of continued buying, and that there is more hope for real prosperity than there ever was for the fictitious variety which follows sharp advances of the general price level, are erected on solid foundations of fact.

The adjustment of industrial operations to the level of consumption is still under way. Judge Gary says steel buying is increasing, but the trade reviews say that the peak of production was probably passed in March, new orders are below shipments and shipments are below production. Prices are easing, but the recession is orderly and it comes as no surprise.

Reports from the building trades are superficially contradictory, but an increase of 11 per cent over last year in contracts awarded and a decrease of 16.3 per cent in permits issued are easily reconciled as indicating an early start in seasonal construction and heralding a falling off later in the year. The movement of materials is thus far rather disappointing.

Automobile production is increasing and apparently exceeds sales. The seasonal expansion may continue for some time yet, but as in other industries the output will have to be reduced again to the limit of ultimate distribution. Coal is already far along the road of readjustment and the accumulated stocks which are responsible for the present depression must now be decreasing to some extent.

The completion of the sale of Dodge Bros. to the public by the offering of $85,000,000 in preference stock, representing the earning capacity and good will, to be followed by $75,000,000 in bonds representing the property, was impressive both by a large oversubscription and by the demonstration of the number of small investors who are anxious and able to become partners in well and favorably known firms in whose product they have confidence. It is also a demonstration of the plenitude of credit, which is further evidenced in the continuing ability of the banks to finance business without any great recourse to the Federal Reserve Banks, whose combined statement shows a reserve ratio only 3 per cent less than last year though they have in that period lost more than $250,000,000 in gold.

A further step taken by France along the road of inflation in admitting that the limit placed on the note circulation of the Bank of France will have to be raised to legalize a situation that already exists, apparently should result in a further decline of the franc, but it has held remarkably steady and it is so evident that the government has all the resources necessary to "intervene" in its support that speculative selling is deterred. If France meets her problem courageously she ought to be able to avert any real disaster to her now reasonably stable currency, but the political difficulties in the way are recognized and the outlook is admittedly a dark spot in an otherwise tranquil and progressing Europe.

What's Doing in Industry

From most sections of the country, with the exception of Milwaukee, come reports of declines in the volume of sales and inquiries in the machinery and machine tool industry. Detroit reported that while business had been good for several weeks, the past week was the quietest in some time. New York reported less business than usual and other cities of the country where machine tools are built concur.

One of the reasons why there has been a falling off is found in the fact that the railroads in all parts of the country have ceased buying except for the barest necessities. What has prompted the economy is not known as transportation has been heavy and reports show earnings to be fairly satisfactory. Even roads that had lists out during the past month have failed to close on many of the items enumerated in spite of extra sales effort put forth by dealers.

The automobile situation is another anomaly as production figures are higher than usual,, certainly higher than anticipated a few weeks ago. Yet without warning machine tool buying has stopped in the Michigan districts and there have been but few orders in other parts of the country.

A bad feature of the present market is that inquiries have also fallen off which means that future business will probably be light. Unless there is a marked increase during the last two weeks of the month, April may prove to have been the poorest month of the year, and with moderate improvement it may not do any better than equal January.

Used tools are selling in all parts of the country.

Exporting was not up to the other weeks of the year, although this business has been unusually good for some time past.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Cincinnati

The outstanding feature of the machine tool market during the past week has been the increased number of sales that have been made to the automotive industry. For several weeks inquiries have been coming in from makers of automobiles and trucks, and at last these are developing into orders. Reports of increased activities in the automobile trade are taken as a sure indication of an increased demand for machine tools.

Production in the metal trades industries is stated to be 65 to 75 per cent of what it was at the peak period of 1920, and about 80 per cent of what it was last year, taking the average production.

Some machine tool manufacturers state that the demand is greater from the East than from the West, but others state that with them it is the reverse. While some orders are coming from the railroads, the demand from this source is still sluggish, and the increase is not what it was expected to be. Nevertheless, the number of inquiries from railroads is increasing.

At present it seems that the smaller industries are more active than the large ones, and consequently there is more demand for machine tools from the former than from the latter. Taken as a whole, this condition is regarded as encouraging, for ultimately the large concerns will participate in the trade betterment.

Milwaukee

Experiences of manufacturers of metalworking equipment in Milwaukee and the Wisconsin territory vary widely with respect to the state of activity. Some are getting a relatively excellent run of orders, while others are able to keep their production from falling into a decline only by the most energetic measures. The call for tools continues spotty as to source, and very uneven as to volume from week to week. The majority report, however, is in favor of a slight but gratifying improvement.

Manufacturers of tools who have developed designs of a highly specialized character are meeting a good demand, and their production as a rule is being concentrated to a large extent upon these tools. In some instances the special equipment is becoming standard almost to the exclusion of what has been known as standard or stock machines.

Export trade has been gradually turning toward special tools, and sales of stock types are relatively very few. A builder of grinders for example, is behind on domestic and export orders for his internal grinder. Recent deliveries include two items to the Fiat Corporation in Italy, seven to automobile and bearing manufacturers in Germany, and lesser numbers to Austria, Sweden and England. The Australian plant of the Ford Motor Co. has ordered a number of the grinding machines.

Inquiry from the American automobile trade indicates that passenger car builders are making ready for materially increased output after the distributors and dealers experience the expected spring demand. While this will not require enlargement of factories or notable additions to production tools, the general effort to cut down costs and produce means important replacements of older tools with modern ones.

Purchases of equipment for automobile factory additions, as in the case of the Nash Motors Co., still contribute to activity in the tool trade. The bulk of this business, it appears, has now been placed and, while production is favorably affected thereby, new business is less active.

Prospects are for a moderately steady run of new business, mainly of a replacement character.

Southern District

Interviews with machinery and tool and supply dealers in Atlanta indicate that business has about held its own during the last two weeks, and that there is more optimism than ever prevalent in the trade over the outlook for spring sales. The primary reason given for this optimism is the great amount of new industrial construction that is in progress in the Southeastern states, reports from authentic source indicating that practically all the leading industries of the district are establishing better records than last year, in spite of the fact that the first half of 1924 was one of the largest industrial expansion periods in the history of the South.

Marked activity in new building is noted in the foundry and machine shop industries, while considerable activity continues to prevail in every part of the South in new automotive plants and service stations by dealers and distributing concerns.

This expansion is resulting in a pick-up from week to week in the number of inquiries for equipment, and these are beginning to develop some good business. The early half of April will better the last half of March in the sales volume, while the month as a whole is expected by the Atlanta trade to prove the best so far this year, according to all indications.

Service stations are reported very active in the market for second hand and rebuilt tools, and some of this business also is reported from the smaller machine shops.

Railroads continue active in the market for tools and equipment, and with still other important shop and terminal projects announced during the last two weeks of March this business will very likely continue to show activity for an indefinite period.

Inquiries from nearly all sources are reported fair to good, showing an increase the last half of March over the first half.

Detroit

Activity in the machine tool and machinery market in Detroit and southeastern Michigan has experienced one of those lulls that seem to come from nowhere and disappear almost as soon as they come.

The recent purchase of Dodge Brothers, Inc., by Dillon, Read & Co. of New York, and the recurrent rumors in the automotive field that consolidations are imminent and that important announcements concerning many plants are almost ready to be released have served to quiet the market to a very considerable extent. This has not been unexpected on the part of the representatives of machinery companies here, but the belief is held that the condition will soon pass.

It is pointed out that a new automobile production record is in the making, and if the April figures do not set up a new mark, the May figures will. Business conditions in general are in a very healthy condition, and the present lull cannot last long, in the estimation of local dealers.

The Simoniz Service & Sales Co., Detroit, is in the market for a small list of tools.

Inquiries for lathes and milling machines are being received in goodly quantities.

New York

A few inquiries and some small sales of single machines were about all that happened in the New York machinery and machine tool market last week. Some of the smaller Southern railroads have been buying, but the main lines have simply stopped purchasing which leaves the market rather flat. General industrials during the week made a few purchases and the General Electric Co. bought on a small list for one of the New England plants. Car builders and locomotive makers have not been in the market in several weeks and, while indications point to buying from this source, the present frankly dull situation has not been helped.

Smaller and cheaper tools seem to have the call over expensive ones in the East just at present. Small presses are selling well and lathes of the simpler variety have been in fair demand.

The automobile makers in and around New York City have been inquiring for tools and some few sales have been made, but this business—never too active—is also below expectations.

Dealers in used tools report a fairly good business with an active call from

traction companies, textile fabricators in New England and general industrial repair shops. There has been no trouble in securing good tools at reasonable prices.

Exporting, that has been unusually good for the first three months of the year, has also slackened its pace, but is still above average.

Chicago

The Chicago machine tool trade is depending to a great extent upon railroad requirements for present business. Industrial demand thus far in the year has been somewhat disappointing.

Not a little dissatisfaction is expressed at the delay of railroads in placing orders after having sent out inquiries and specifications. This tardiness has a tendency to unsettle conditions as well as to cause impatience, but it is realized that nothing can be done to remedy the situation, as railroads will not be hurried. A phase of the situation frequently discussed among machinery men in this connection is that such inquiries as railroads are making do not nearly cover their actual requirements, economy and retrenchment being generally enforced as necessary by practically all the big roads.

A member of one of the large local firms handling machinery said that one of the principal Western railroads whose budget sets forth requirements for machine tools totalling about $125-000, was in need of $500,000 worth of new machinery equipment.

Generally speaking, business in the machine tool market is inactive, but there is some satisfaction in the fact that the month of March shows a slight improvement over February in the volume of business transacted.

New England

Heavy machinery buying in the last week has been confined almost exclusively to the automotive industry. Not only in the actual sales, but also in the volume of inquiries is the favorable conditions of automobile industry sharply defined. At least that is how it appears in the industry of Connecticut and Massachusetts.

Automatics are in good demand.

Special machinery builders report that prospective business is indicative of a good character of trade to be expected within the next three months.

Manufacturers of screw machine products report their present business is good and indications are more promising.

Among the manufacturers of hand tools there is a feeling that their present activity will be dwarfed by trade to develop shortly. This is measured somewhat by the increasing building operations. Hardware manufacturers, too, are anticipating greater demand. In the hardware center the industries are operating on full time schedules and there is some buying of presses for expansion purposes. An already large hardware manufacturing company has staked out profiles for a new factory building, but are withholding the general dimensions.

In some quarters it was stated that business on the books warranted greater operations, but the general policy was to endeavor to maintain normal working hours, giving additional employment where there were facilities. Employment is on the increase quite generally throughout the trade in New England.

Cleveland

A decided improvement has appeared in the machine tool industry within the past two weeks. This condition is encouraging as the first three months of 1925 have been dormant. Manufacturers are very optimistic about the near future as inquiries received in the past weeks indicate that business is on the up grade. The general opinion is that within three months all plants will be operating on a full time basis. One manufacturer has recently added a night shift in order to complete present contracts, anticipating an influx of new business.

Present inquiries indicate that structural steel fabricators, railroads, car shops and automobile industries are the prospective buyers. Formal bids are being received by school boards for machinery for work shops.

Orders for the local automobile industry are on the increase. The White Motor Co. was recently awarded a $3,000,000 contract to construct a fleet of road buses. Additional special machinery will be required.

The planer and lathe market is active. The punch and shear market is quiet.

Philadelphia

Philadelphia business men profess to see in the present industrial situation an inclination to better business in the near future. Machine tool manufacturers base their belief for improvement on the fact that some live inquiries have been received in the last few weeks, which according to all rules of economics, should result in some substantial orders soon.

At the present time, however, the manufacturers are living more on hope than on actual developments toward better conditions. For months past, some of the larger manufacturers and dealers have been quoting prices on tools and machinery of various sorts, but so far few material orders have been booked. It is the belief of the heads of these concerns that the inquiries soon will result in substantial purchases.

Used machinery is moving, but dealers say business is far from being what they had hoped for with the coming of the early months of 1925.

The Pennsylvania Railroad Co. is buying only what tools it needs for immediate uses. There is nothing to indicate that the company will embark on any extensive buying program this year.

Indianapolis

A little improvement is noticed in both machinery and machine tool business in this district. The improvement is not great, but it is evident and a greater volume of inquiries leads the local trade to believe that business will show further gains before mid-summer. In the first place, there is a little expansion in the automobile trade which has been quiet since the first of the year. However, nothing phenomenal is expected this spring.

Foundries, both in ferrous and nonferrous metals, are somewhat more active buyers than they have been and the fabricators of structural steel are especially busy. Their tooling and machinery requirements are increasing. Another good purchaser of both machinery and tools is the farm implement trade in the state. Several good sized implement manufacturers are located in Indiana and are coming to be steady buyers.

Railroad demand is light, only such repair work as is absolutely necessary being done in Indiana. The demand from public utilities, notably electric and interurban, is fair with prospects of increased business during the late spring.

Used machinery brokers say business is good in many lines and in some instances there is a dearth of used machinery to sell.

Machine Tool Builders Seek Statistics

Negotiations are in progress between the Bureau of the Census and the National Machine Tool Builders' Association looking to the compilation of certain statistics of the machine tool industry. The Machine Tool Builders' Association discontinued its statistical work pending the clarification of the legal questions involved. Since that time the industry has come to have a new appreciation of these figures and finds it difficult to conduct business intelligently without them.

While the Census Bureau is willing to co-operate with industry in the compilation and publication of essential statistics, the amount of this work is limited by the funds at its disposal, but arrangements can be made to handle a fairly comprehensive service for the tool builders. The Bureau now is furnishing such service to some twenty-five industries.

Duesenberg Company Is Reorganzied

The final steps in the reorganization of the Duesenberg Co., Indianapolis, Ind., were taken recently, when the assets and property of the old company were bought by the stockholders' protective committee and the creditors' committee and the property was turned over to the newly organized Duesenberg Motors Co. for $375,000.

New Steel Mill Opened at Terre Haute

A deal has been closed that transfers the holdings of the Hoosier Rolling Mill Co., Terre Haute, Ind., to the Interstate Steel & Iron Corporation, New York City. The new company intends to reopen the plant within the next 30 days, giving employment to at least 900 men at first and gradually increasing its number of employees to 1,500 or more men, according to announcement. The new company will spend $2,000,000, it is said, in improving the plant.

British Machine Tool Association

The retiring members of the council of the British Machine Tool Trades Association (Incorporated), namely, Messrs. J. W. S. Asquith, E. R. Brayshaw, H. Butler, A. L. Churchill, W. F. Clark, R. W. Cunliffe, W. H. Day, J. W. Darling, J. R. C. Kearns, H. M. Selson, and H. G. Sagar, have been re-elected without opposition.

Daniel H. Meloche Awarded Longstreth Medal

Daniel H. Meloche of the Holley Carburetor Co., Detroit, has been signally honored by the Franklin Institute, Philadelphia, which has awarded him the Edward Longstreth medal for his invention embodied in long life moulds.

Mr. Meloche, who is but 36 years of age, is probably the youngest man ever to receive this medal.

Will Purchase Equipment

The Kansas City, Mexico & Orient R.R. has applied to the Interstate Commerce Commission for authority to issue receiver's certificates to apply on the purchase of the following equipment: Four locomotives; 350 box cars; 100 stock cars; 50 automobile cars; 25 dump or ballast cars, and one new Jordan spreader; and for the rebuilding of 650 old box cars, 100 stock cars and 150 coal cars.

Calendar of Local Meetings

San Francisco, Calif. April 16. Local meeting. "Engineering and Finance," Guy Emerson. F. Birdsall, secretary, the Bethlehem Shipbuilding Corporation, Ltd., San Francisco, Calif.

Bellingham, Wash. April 17. Local meeting. "Portland Cement Grinding," Mr. Krobbe. R. L. Rockwell, secretary, 955 Empire Building, Seattle, Wash.

Salt Lake City, Utah. April 18. Local meeting. "Training of Industrial Foremen." W. H. Trask, Jr., secretary, University Club, Salt Lake City, Utah.

State College, Pa. April 18. Local meeting "Power Plants for Air Craft," Lieut. Commander E. E. Wilson; "Management," Wallace Clark. Prof. L. J. Bradford, secretary. Pennsylvania State College, State College, Pa.

Allentown, Pa. April 20. "Industrial Coal, Its Purchase, Delivery and Storage." N. E. Funk, F. V. Larkin. H. E. Broughton, secretary, the Trojan Powder Co., Allentown, Pa.

Philadelphia. April 21. "Gas Production and Use for Heating, Power and Illuminating Purposes." H. S. Harris, secretary, 410 Commercial Trust Building, Philadelphia, Pa.

Birmingham, Ala. April 21. "Material Handling." Several speakers will speak on different phases, including cable haulage, gondola car dumpers, belt conveyors in mines, and hydraulic power as an aid. G. L. Bentley, secretary, the Ingersoll-Rand Co., 1802 American Trust Building, Birmingham, Ala.

Schenectady, N. Y. April 21. "The Oil-Electric Locomotive." F. W. O'Neil. G. B. Warren, secretary, the General Electric Co., Schenectady, N. Y.

Houston, Texas. April 21. "Crude-Oil Engines." O. N. Edgar, secretary, 616 Second National Bank Building, Houston, Texas.

Knoxville, Tenn. April 21. "Gas Power." Dean C. E. Ferris, H. L. Macon, H. Gmeiner, W. R. Woolrich. Prof. Woolrich, secretary, University of Tennessee, Knoxville, Tenn.

New York. April 22. "Oil Engine Locomotives." E. G. Katte, L. G. Coleman and Elmer A. Sperry. F. J. Bechert, secretary, 350 Madison Ave., New York City.

Cincinnati, Ohio. April 23. "The New Miami Station of the Union Gas & Electric Co.," C. W. DeForest. Prof. J. T. Faig, secretary, Ohio Mechanics' Institute, Cincinnati, Ohio.

Toledo, Ohio. April 23. Afternoon and evening sessions. "Oil and Gas Power." Dr. Druse. H. L. Allen, secretary, the Toledo Scale Co., Toledo, Ohio.

Washington, D. C. April 23. "Diesel Engines in Submarines." E. C. Magdeburger. H. M. Roesser, secretary, the United States Bureau of Standards, Washington, D. C.

Los Angeles, Calif. April 23. "Conservation of Oil and Gas Fuel." R. M. Peabody, secretary, 1201 W. Second St., Los Angeles, Calif.

Atlanta, Ga. April 24. Joint meeting with A.S.C.E., and A.I.E.E. "The Use of Oil-Fired Furnaces in Residences." A. M. Schoen. E. W. Connell, secretary, 41 Miller Ave., Atlanta, Ga.

Denver, Colo. April 24. "Shop and Production Methods in the Burlington Shops of Denver." Charles Erwin. William Lester, secretary, the Vulcan Iron Works, Denver, Colo.

Columbus, Ohio. April 24. "Oil and Gas Power." H. F. Shepard, J. E. Dykatra and L. H. Morrison. Arthur Richards, secretary, Chillicothe, Ohio.

Spokane, Wash. April 24. "Motor Fuels of the Future." L. S. Pospisil. L. J. Pospisil, secretary, Washington Water Power Co., Spokane, Wash.

Minneapolis, Minn. April 27. "Commercial Oil Burning." Edward Larkin. Prof. B. J. Robertson, secretary, the University of Minnesota, Minnapolis, Minn.

Portland, Ore. June 22 to 25. Pacific Coast Regional Meeting.

Society of Automotive Engineers

Detroit Section. April 16. "Sheet Metal." F. R. Pleasonton.

Metropolitan Section. April 16.

Chicago Section. April 17. "Design of the Diesel Engines." Philip L. Scott.

Cleveland Section. April 20. Production Meeting. Symposium of practices in machining connecting rods. Cleveland automobile companies.

Los Angeles Section. April 24. "Los Angeles Major Traffic Plan." David R. Faries. "Can Motor Buses Relieve Congestion?" Phil. Harris.

Washington Section. April. 24. "Around the World Flight." Lieuts. Leigh Wade and Leslie P. Arnold.

San Francisco Group. April. 30. "Six-Wheel Trucks." Ethelbert Favary.

Milwaukee Section. May 6.

Pennsylvania Section. May 12. Trip to Naval Air Station, Lakehurst, N. J., with talk by Naval officers.

Buffalo Section. May 19.

American Society for Steel Treating

Schenectady, N. Y. Spring Section Meeting. May 28, 29 and 30. Hotel Van Curler. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

National Association of Cost Accountants

Buffalo Chapter. April 16. "What Information Does the Banker Want," and "Preparing Cost Data for Managerial Control."

Philadelphia Chapter. May 8. "Material Control." N. M. Cartmell.

Milwaukee Chapter. May 12. Annual election of officers.

New York Chapter. May 12. "Cost Accounting to Aid Financial Control and Forecasting." S. H. Childs.

Buffalo Chapter. May 14. Annual election of officers.

Twin Cities Chapter. May 14. A review of all previous topics of the series. Election of officers.

Cleveland Chapter. May 20. "Retailing-Reaching the Consumer," and "Uniform Costs for the Retailer."

Rochester Chapter. May 20. "Methods of Applying Selling and Administration Expenses to the Product." Prof. Charles Reitell.

Syracuse Chapter. May 20. Subject to be announced. Percy S. Brown, the speaker.

Detroit Chapter. May 21. "Experience in Simplifying the Cost System."

American Welding Society

Boston. April 17. Prof. V. O. Homerburg and C. E. Littlefield.

Philadelphia. April 20. S. W. Miller, "Welding Pressure Vessels."

Cleveland, April 21. Interesting welding jobs. Mr. Boom of Boom Boiler & Welding Co.

Trade Catalogs

Punch Riveters. The Hanna Engineering Works. 1765 Elston Ave., Chicago, Ill. The wide adaptability of this riveter and the speed of operation are stressed in a catalog recently issued. The product is illustrated and minutely described and there are specifications and sectional drawings.

Lifting Magnets. The Ohio Electric & Controller Co., Cleveland, Ohio. These magnets are shown doing some very interesting work such as lifting steel ingots, scrap, awkward pieces and other feats that magnets are called upon to perform. Besides the illustrations and descriptions are drawings.

Lift Trucks. The Plimpton Lift Truck Corporation, Stamford, Conn. Four wheels is the feature that is stressed in the new catalog of the Plimpton corporation. There is a list of users, illustrations showing the trucks in use and descriptive matter setting forth the virtues of the truck.

Governors. The American Bosch Magneto Corporation, Springfield, Mass. This mailer contains a sectional view of the governor made for Fordson tractors and describes the various features.

Forthcoming Meetings

American Welding Society. Annual Meeting. April 22, 23 and 24. Engineering Societies Building, 29 West 39th St., New York City.

National Metal Trades Association. Twenty-seventh annual convention. Hotel Cleveland, Cleveland, Ohio, April 22. J. E. Nyhan, national secretary, Peoples Gas Building, Chicago, Ill.

The National Supply and Machinery Distributors' Association. Twentieth annual convention, Ambassador Hotel, Atlantic City, April 27, 28 and 29. George A. Fernley, secretary and treasurer, 505 Arch St., Philadelphia, Pa.

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers Association, Joint Convention. The Atlanta-Biltmore Hotel, Atlanta, Ga., May 5, 6 and 7. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

The Society of Industrial Engineers, National Convention. Hotel Winton, Cleveland, Ohio, May 6, 7 and 8. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago, Ill.

American Gear Manufacturers' Association. Ninth annual convention, May 6, 7 8 and 9. The William Penn Hotel, Pittsburgh, Pa. T. W. Owen secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Division V of the American Railway Association. Business meeting June 16 to 18, Chicago. V. R. Hawthorne, 431 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19. C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., in August. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Present trend in pig iron industry is toward curtailment of production and maintenance of prices at present levels, which are about 50c. to $1 per ton below April 3. Principal changes in steel prices during week were declines in scrap, sheets and semi-finished material. Bars are $2.10; plates, $2@$2.10; and shapes, $1.95@$2.10 per 100 lb. at Pittsburgh mill. Bars are firmest and shapes, weakest of principal hot-rolled products. Drop in demand is shown by total of 4,863,564 tons of unfilled orders on books of the U. S. Steel Corp., Mar. 31, against 5,284,771 tons, Feb. 28. There were, however, 4,782,807 tons unfilled on Mar. 31, 1924.

Non-Ferrous Materials—Copper, zinc and antimony are growing firmer; lead dropped ¼c. per lb. in week; tin is at lowest point touched in past six months. Red and white lead declined ¼c. per lb. during past nine days.

(All prices as of April 10)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	23.27
Southern Ohio No. 2	23.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	31.25
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.26
Virginia No. 2	30.17
Basic	24.26
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	21.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70	3.89	3.45	3.80
No. 12	2.80	3.94	3.50	3.85
No. 14	2.90	3.99	3.55	3.95
No. 16	3.10	4.09	3.65	4.15
Black				
Nos. 17 and 21	3.35@3.45	4.55	4.15	4.30
Nos. 22 and 24	3.40@3.50	4.60	4.20	4.35
Nos. 25 and 26	3.45@3.55	4.65	4.25	4.40
No. 28	3.50@3.60	4.75	4.35	4.50
Galvanized				
Nos. 10 and 11	3.65@3.75	4.75	....	4.50
Nos. 12 and 14	3.75@3.85	4.85	....	4.60
No. 16	3.90@4.00	5.00	....	....
Nos. 17 and 21	4.05@4.15	5.15	....	4.90
Nos. 22 and 24	4.20@4.30	5.30	3.00	5.05
No. 26	4.35@4.45	5.45	4.15	5.20
No. 28	4.65@4.75	5.75	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.09	50%	⅞	$0.16	35%
¼	.11	45%	1	.18	31%
⅜	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	7.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	7.00	8.25	7.85
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00@3.10 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%¼

Electric welding wire, New York, 3/32, 8.35c.; 1/8, 7.85c.; 5/32 to 1/4, 7.35c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7¼c.; 1/8, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.00
Tin, 5-ton lots, New York			51.25
Lead (up to carlots), St. Louis	7.80	New York	8.75
Zinc (up to carlots), St. Louis	7.15	New York	7.87½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	15.00	17.75	....
Copper sheets, base	22.00	21.75	22.12½
Copper wire, base	19.87½	21.25	20.75
Copper bars, base	21.12½	21.50	22.62½
Copper tubing, base	24.00	24.25	25.75
Brass sheets, base	18.37½	18.62½	19.25
Brass tubing, base	23.00	25.25	25.00
Brass rods, base	16.12½	16.37½	18.37½
Brass wire, base	18.87½	20.12½	20.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	27.20	28.00	27.00
Zinc sheets (casks)	11.00	11.50	11.37
Solder (½ and ½), (case lots)	36.00	37.00	....
Babbitt metal (83% tin)	60.00	63.00	50.00
Babbitt metal (35% tin)	28.00	20.50	28.00
Nickel (ingots) f.o.b. refinery	29.00	....	....
Nickel (electrolytic) f.o.b. refinery	33.00	....	....
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.00@11.50	11.25	11.25
Copper, heavy, and wire	10.75@11.25	11.00	11.00
Copper, light, and bottoms	9.50@10.00	9.00	9.00@9.75
Heavy lead	6.50@6.75	6.50	6.50@6.62½
Tea lead	5.50@5.75	4.00	4.00@5.62½
Brass, heavy, yellow	6.75@7.25	7.00	7.00
Brass, heavy, red	8.50@8.75	9.00	8.62½@9.00
Brass, light	6.00@6.25	5.50	5.50@6.12½
No. 1 yellow rod turnings	7.25@7.50	7.00	7.00@7.37½
Zinc	4.25@4.50	3.75	3.75@4.37½

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.80	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	12.20	13.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14@0.16
Cotton waste, colored, per lb.	.10@.15½	.18	.09½@.12¾
Wiping cloths, 13¼x13¼, per lb	.09½@.09¾	36.00 per M	.11
Wiping cloths, 13¼x20½, per lb.	....	50.00 per M	.11
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.60	3.25	3.75
Linseed oil, per gal., 5 bbl. lots	1.09	1.24	1.25
Lard cutting oil, 25% lard, per gal.	.60	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.33	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	40–2½%
Heavy grade	30–5%	30%	38–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–5%	60–5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0349
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb	.1612½	.1762½	.16
Solder (½ and ½)	per lb.	.36	.42	.39
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.60	.60	.55
Machine oil	per gal.	.33	.33	.29
Belting, leather, medium	off list	40–2½%	40–2½%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	....
Emery paper	10.71	11.00	$11.90
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.65
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag	....	.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.25@3.75
Coke, prompt foundry, Connellsville	per net ton		4.00@4.50
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1¼x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1¼x¼-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ½x¼-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c., longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅜-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., New Haven — M. Langrock and R. L. Klautz, c/o A. W. Boylen, 39 Center St.—equipment for 2 story garage.

D. C., Washington — A. L. Flint, Gen. Pur. Officer of the Panama Canal, will received bids until April 21, for moulding machines, scales, pumps, boiler punches, reamers, hacksaw blades, etc.

Ill., Chicago—Chicago Union Station Co., W. G. White, Pur. Agt.—6 x 6 in hack saw, 18 x 10 in geared head, engine lathe, 20 in. back geared shaper, 1¼ x 6 in. pipe machine, grinder with 12 x 2 in. wheels, grinder with 8 x ¾ in. wheels, 20 in. sliding head upright drill.

Ill., Chicago—K & S Mfg. Co., 1315 West 21st St., J. Kuiki, Pur. Agt. (automobile apparatus)—machinery for new factory.

Ill., Chicago — Kremer Metal Products Co., 721 Fulton St., J. Anderson, Pur. Agt. —machinery and tools for new plant at Muskegon, Mich.

Ill., Chicago—Mack International Truck Co., 1808 South Michigan Ave., L. W. Moody, Pur. Agt.—equipment for truck repair and service shops, garage equipment, etc., for new building.

Ill., Chicago—Metal Specialties Co., 1513 Madison St., M. J. Lebovits, Pur. Agt.—machinery and tools for metal working for new factory.

Ill., Chicago—Chicago Meter Service Co., 7656 South Halsted St., M. O'Toole, Secy. (manufacturers of meters)—additional machinery and small tool equipment, to increase shop output.

Ill., Chicago—John Michels, 1112 North California Ave., equipment for new brass foundary.

Ill., Chicago — Phoell Mfg. Co., 5700 Roosevelt Rd., W. Barrows, Pur. Agt. (screw manufacturers)—additional screw making machinery of all types, also machine tools and equipment for factory building.

Ill., Chicago—Premier Electric Co., 1800 Grace St., J. Brown, Pur. Agt. electric specialties)—additional machinery and tools for new addition to plant

Ill, Chicago—Sellers Mfg Co., 4651 Pensacola Ave., H. J. Stunts, Pur. Agt.—equipment for new iron rolling mill.

Ill, Chicago—G. H. Stoehling Co., 3047 Carroll Ave., C. H. Stoehling, Pur. Agt. (manufacturer of scientific instruments)—complete equipment for new machine shop.

Ill., Chicago—L. Vallas, 2855 West Lake St.—tinsmith equipment and sheet metal working machinery for new shop.

Ill., Chicago — Van Schaak Bros. Chemical Wks., 3358 Avondale Ave. — drills, lathes, etc., for 2 story machine shop.

Mass., Attleboro—School Bldg. Committee—manual training equipment, including woodworking machinery for new high school.

Mass., Boston — A. B. Wells, 94 West Cedar St.—miscellaneous tools and equipment for 2 story service and repair garage.

Mass., Cambridge—Dunster Realty Co., Auburn and Boylston Sts.—miscellaneous tools and equipment for addition to repair and service garage.

Mass., Everett — W. Symmes, 40 Gledhill Ave.—equipment and repair tools for new service and repair garage on Burdette Lane.

Mass., Roxbury (Boston P. O.)—H. Rittenberg, 12 Graden St.—equipment and miscellaneous tools for repair and service garage.

Mich., Detroit—A. N. Haskell, 2924 Lakeview Ave.—ball bearing drill presses (used).

Neb., Omaha — Union Pacific R.R. Co., 15th and Dodge Sts., G. W. Bickimeir, Gen. Pur. Agt.—3 sensitive bench drill presses, directed motor driven for Huntington shops.

N. Y., Buffalo—H. B. Clifford, 67 Albany St.—tools and equipment for garage repair shop.

N. Y., Buffalo—S. Dubiel, 653 Hertel Ave.—drill press, lathe and small tools, for service station and garage.

N. Y., Buffalo—L. K. Weeks, 74 Jewett Ave.—equipment for light manufacturing of metal products.

N. Y., Buffalo—Wolf & Sturm, 3065 Baily Ave.—equipment and tools for garage and repair shop.

N. Y., New York—West Virginia Pulp and Paper Co., 200 Fifth Ave.—two 15 ton electric hoists, for Tyrone and West Virginia plants.

N. Y., Rochester—Homer Strong & Co., Inc., 301-307 State St.—36 or 42 in. wide Ingersoll mill, 10 to 12 ft. bed, 4 heads.

Pa., Hanover—Mummert-Dixon Co., E. S. Mummert, Pres. and Gen. Mgr.—3 ton and 5 ton hand cranes, with electric hoists.

Pa., Philadelphia—Pennsylvania R.R. Co., Broad Sta., S. Porcher, Pur. Agt.—20 in. upright drill, 5 ft. radial drill, and combination punch and shear for Altoona shop.

Pa., Pittsburgh—Bd. of Education, Fulton Bldg.—belt sanding machine.

Pa., Pittsburgh—Imber Supply Co., Chestnut and Spring Garden Ave.—5 ton, 35 ft. span warehouse crane.

Pa., Pittsburgh—The Koppers Co., Union Trust Bldg.—15 ton bucket handling crane, for new byproduct plant, for Jones & Laughlin Steel Corp., Woodlawn.

Pa., Pittsburgh — United Engineers & Foundry Co., Farmers Bank Bldg., W. Samborn, Pur. Agt.—7½ ton, 31 ft. 8 in. span, electric crane for Lincoln works.

Tex., San Angelo—W. B. Willig—20 or 30 in. lathe, with 16 or 18 ft. bed.

Tex., Waco—Methodist Orphanage, M. W. Scott, 412½ Franklin Ave., Archt.—machinery suitable for manual training garage.

Wis., Green Bay—New Device Mfg Co., c/o G. A. Lindstrom, 415 Crooke Ave. (manufacturers of furnace pipe, etc.) — sheet metal working machinery.

Wis., Milwaukee—Ortman Co., P. O. Box 673—small engine lathe.

Wis., West Allis—Gerlinger Steel Casting Co., 60th Ave. and Mitchell St.—moulding machines for new foundry.

N. B., Petitcodiac—R. A. Mitton—complete equipment for garage and auto repair shop.

N. B., St. John—Lewis Conners & Son Ltd.—complete equipment for machine shop.

Ont., Frood—Mond Nickel Co., Coniston —equipment for new 35 x 120 ft. machine shop, here.

Ont., Gobles—J. Hoffman—equipment for sawmill to replace fire loss of $25,000.

Ont., Hamilton — P. B. Yates, Machine Co., Cavell Ave.—hand hole machine for wooden box manufacture.

Que., Montreal—T. Gauthier, 116 Moursean St.—complete equipment for garage and service station, on Des Ormeant St.

Opportunities for Future Business

Conn., New Britain—F. Beloin, will build by separate contract a 3 story, 85 x 180 ft. garage and stores building, on Church St. Estimated cost $150,000.

Calif., Berkeley — Pacific Electric Clock Co., 86 Third St., awarded contract for the construction of a factory on Parker St. $42,000.

Calif., Emeryville—Pacific Gas & Electric Co., 445 Sutter St., San Francisco, will soon receive bids for the construction of a group of buildings including 2 story foundry, machine shop, electric and pattern shop, etc. Engineering Dept. in charge.

Calif., San Francisco—Lessor, Aronson and Schoenberg, 58 Second St., plans the construction of a 10 story, garage, store and office building, on Fourth St. Estimated cost $1,000,000. Architect not selected.

Mass., Newtonville (Boston P. O.)—Newton Motor Sales Co., West Newton Sq., Newton, is receiving bids for the construction of a 1 and 2 story, 30 x 70 and 60 x 105 ft. garage, on Washington St., here. Estimated cost $50,000. D. J. McDonald, 77 Summer St., Boston, is engineer and architect.

Mass., Somerville—M. Cota, 14 Mansfield St., is receiving bids for the construction of a 60 x 100 ft. garage, at Main St. and Commonwealth Ave. Estimated cost $40,000. J. A. Quirk, 10 Tremont St., Boston, Archt.

Miss., Centerville—Reed Lumber Co., is receiving bids for the construction of 2 saw mills with 25,000 ft. capacity per 10. hours. Private plans.

Mo., St. Louis—Wrought Iron Range Co., 5661 Natural Bridge Ave. awarded contract for the construction of a 24 x 61 ft. addition to plant. Estimated cost $10,000.

O., Cincinnati—G. A. Gray Metal Planer Co., Gest and Depot Sts., awarded contract for the construction of a 110 x 420 ft. machine shop and office building on Montgomery Rd. Estimated cost $500,000.

O., Columbus—Ralston Steel Car Co., East Columbus St., awarded contract for the construction of three buildings, including a 60 x 180 ft. wheel and axle building, a 63 x 105 ft. addition to main building and 56 x 70 ft. storage building, $55,000.

Pa., Hanover—Mummert-Dixon Co. is building a 80 x 200 ft. machine shop at plant, here. Estimated cost $30,000. E. S. Mummert, Pres. and Gen. Mgr.

Pa., Philadelphia—J. F. Clarke, 23 South 16th St. is taking sub bids, for the construction of a 24 x 60 ft. factory addition, to plant at 3rd and Annsbury Sts., for the Columbia Steel Equipment Co.

Pa., Philadelphia—Horn Surgical Co., 1701 Vine Pl., will soon award contract for the construction of a 66 x 103 77 ft. factory at 53rd St. and Meeting House Lane. Private plans.

Pa., Pittsburgh—Pittsburgh Piping and Equipment Co., 35th and Charlotte St., is having plans prepared for the construction of 3 one story buildings, 120 x 300 ft., 80 x 150 ft., 50 x 220 ft. for the manufacture of pipe. Private plans.

Pa., Zelionple—Atlas Sanitary Manufacturing Co., plans the construction of a group of factory buildings, including foundry, cleaning house, enamel shop and shipping house. Estimated cost $100,000. Private plans.

Wis., Milwaukee—E. W. Clarke, Motor Co., 456 Jackson Ave., awarded contract for the construction of a 3 story, 97 x 118 ft. garage on Ogden Ave. Estimated cost $150,000. Noted Mar. 19.

Wis., Wauwatosa—Goebel & Oberle, 66 Vine St., awarded contract for the construction of a 40 x 48 ft. sheet metal shop on Alice St. Estimated cost $10,000.

Ont., Ottawa—Capital Wire Cloth Mfg. Co. Ltd., 24 Huiton Ave., J. W. Perazzo, Secy., awarded contract for the construction of a factory addition on Huiton Ave. Estimated cost $20,000.

Ont., Toronto — Toronto Transportation Comm., 229 Yonge St. awarded contract for the construction of a 120 x 167 ft. garage, with 34 x 56 ft. addition, on Bathurst St. $150,000.